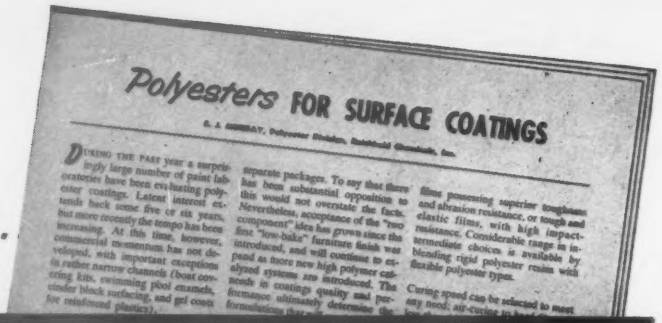
PAINT and VARNISH

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES

write to **RCI** for important new article on...



Polyesters FOR SURFACE COATINGS

DURING THE PAST YEAR a surprisingly large number of paint laboratories have been evaluating polyester coatings. Latent interest extends back some five or six years, but more recently the tempo has been increasing. At this time, however, commercial momentum has not developed, with important exceptions in rather narrow channels (boat covering kits, swimming pool enamels, cinder block surfacing, and gel coats for reinforced plastics)...

separate packages. To say that there has been substantial opposition to this would not overstate the facts. Nevertheless, acceptance of the "two component" idea has grown since the first "low-bake" furniture finish was introduced, and will continue to expand as more new high polymer catalyzed systems are introduced. The needs in coating quality and performance ultimately determine the formulations that will

films possessing superior toughness and abrasion resistance, or tough and elastic films, with high impact-resistance. Considerable range in intermediate choices is available by blending rigid polyester resins with flexible polyester types.

Curing speed can be selected to meet any need; air-curing to heat-

1. Why has European paint industry outstripped U.S. in developing polyester surface coatings?

2. What 10 basic advantages do polyesters have as a coating raw material?

3. Can polyesters extend the field of application for high performance coatings for severe environment conditions?

4. Should you consider development of a polyester surface coating now? For metal? For masonry? For wood?

You will find these and other questions frankly discussed in the article "*Polyesters for Surface Coatings*". Included also are a list and description of **RCI POLYLITE polyester resins specifically developed for surface coatings.**

Write for this important article today. Address your letter to POLYESTER DIVISION, Reichhold Chemicals, Inc., RCI Bldg., White Plains, New York.

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Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
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RCI BUILDING, WHITE PLAINS, N.Y.

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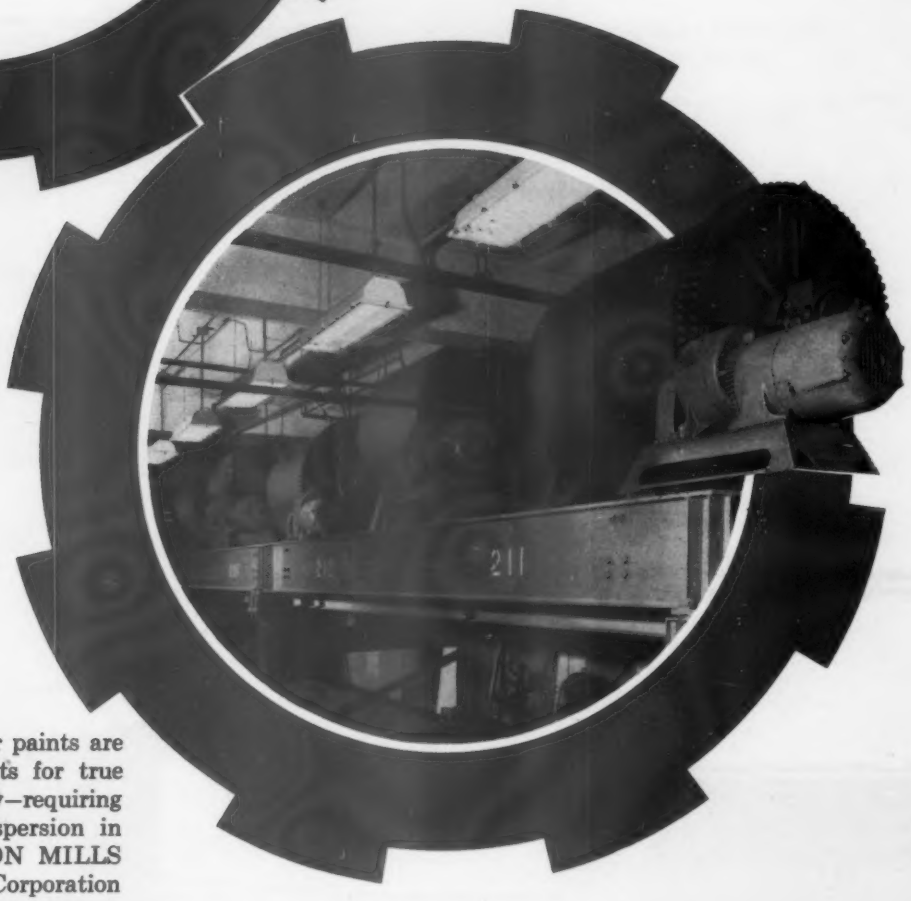

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(Established in 1910 as The Paint and Varnish Record)

VOL. 48 DECEMBER, 1958 NO. 13

FEATURES

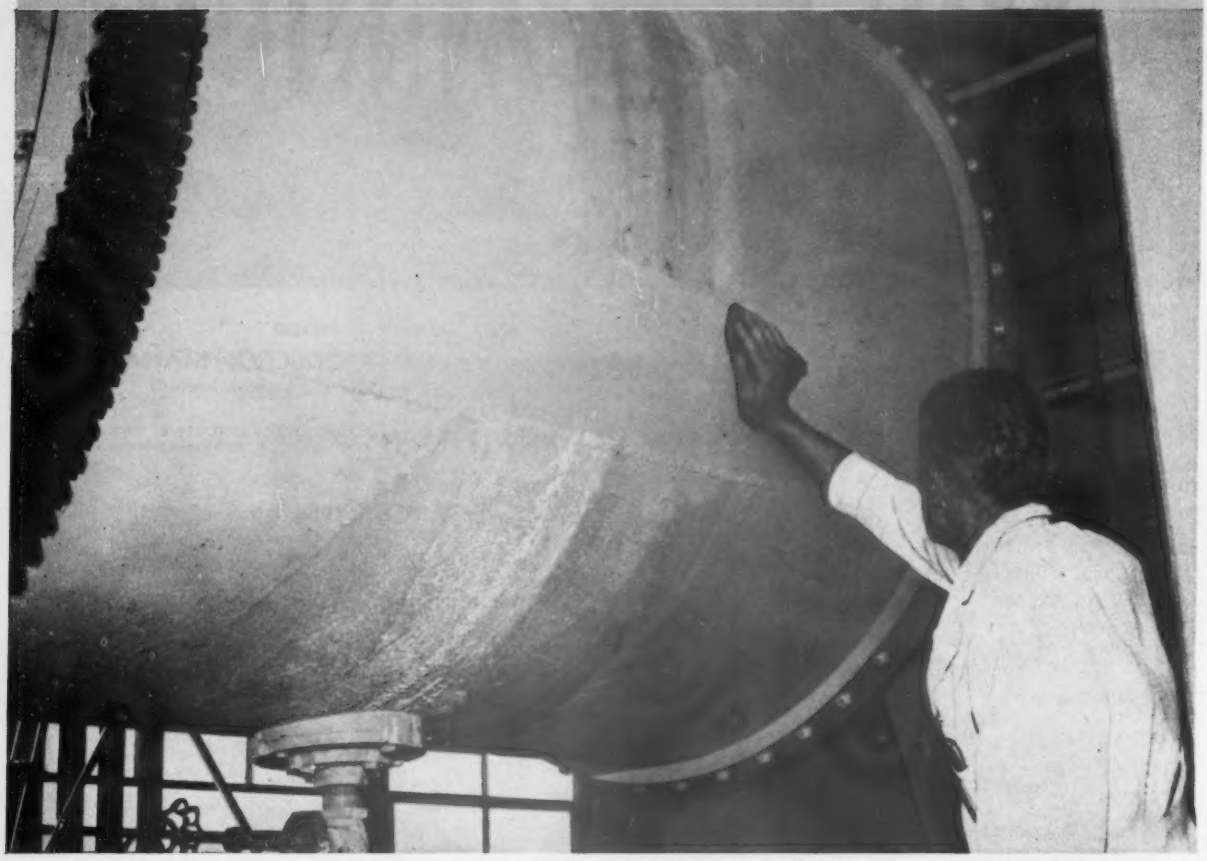
PRODUCTION

FOREIGN DEVELOPMENTS

DEPARTMENTS

Paint and Varnish Production Wishes You
A Merry Christmas and a Happy New Year

At The Glidden Company...



At The Glidden Company, paint drippings from a pebble and steel ball mill are easily cleaned off the Epon resin-based exterior surface coating with a solvent-dipped rag.

Chemical-resistant Epon® resin-based coatings guard paint production equipment from corrosion ...greatly reduce maintenance costs

At one of the paint production plants of The Glidden Company, enamel coatings on equipment were often stripped down to bare metal in only 30 days by the corrosive action of caustic cleaners. Maintenance costs were high.

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EDITORIAL COMMENT

Prove Me Wrong

WANTING to believe and believing may be worlds apart but as one of those who strongly shares in the feeling that the paint industry is a scientific industry, we were rather let down at the recent Federation convention in Cleveland. This let down was the result of the announcement during the granting of the Roon Competition Award that no entries were received for the Class A Member Awards. In other words, out of some 4,000 Class A Federation members, no one was interested enough to win $450, $250, or even $175.

Could it be that among this group no one was capable of competing for this award? We think not. Perhaps there is a feeling among paint chemists that their findings are too precious to share with their fellow workers or, by contrast, are of little significance and not worth talking about.

On the other hand, the paint raw material suppliers have shown a keen interest in the Roon Foundation Awards and have presented some very fine papers in the Open Competition Class.

Two classes of awards were established by the Roon Foundation: (1) The Open Competition Awards which are open to anyone involved in the study of, or engaged in work related to, the protective coatings industries, including paint, varnish and lacquer manufacturers, raw material suppliers, research laboratories and universities, and (2) the Class A Member Awards which are limited to Class A members of the Federation.

Obviously, the establishment of the Class A Member Awards was designed to encourage those technical men of the paint industry, not active in the various technical committees of the constituent clubs, to present papers on some aspect of their work at the annual meeting.

The important requirements of the Roon Foundation Awards: are (1) that the papers shall be of such calibre that they will reflect a step forward in real scientific contribution to the coatings industry, and (2) that the papers must be directly related to the protective coatings industry. The judges are fair minded and would certainly like nothing better than to have a real contest for these awards.

Search your files and notebooks for there must be some good material worthy of presentation, and remember negative results can be just as important as positive results. If, as paint chemists, you do not share in the dissemination of technical information, then you are abdicating your right to be counted as a member of a scientific industry.

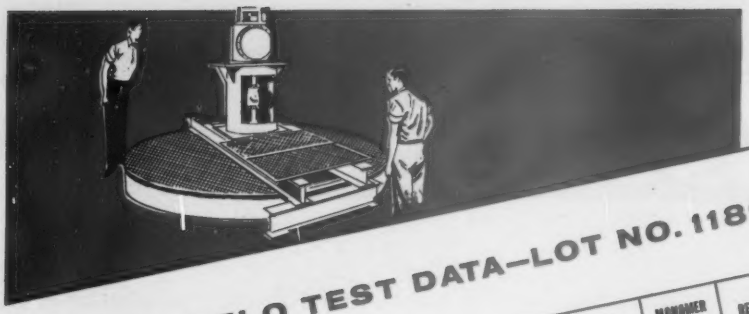
Keep the paint industry scientific and deluge the Roon Award Committee with papers next August for presentation at the 1959 Federation Convention in Atlantic City.

Are You Modernizing?

IN HIS address on the *Potential Contribution of Research* before the Roof Coating Manufacturers Forum of the recent annual meeting of the NPVLA in Washington, Helge Holst of Arthur D. Little, Inc., discussed the importance of avoiding obsolescence in production methods and equipment. He said that what is not so obvious, but must not be overlooked, is that the same factors of competition, and the desire to keep costs from rising any faster than is unavoidable, make it necessary that successful industries continually improve and replace existing production methods and equipment with changes in methods and manufacturing equipment.

In the light of Mr. Helge's remarks, are you critically analyzing your present equipment and methods? For example, are you satisfied with your production output? Perhaps you need improvement in your material methods or your filling and labelling operation can be made more efficient. And what about instrumentation and automation? Perhaps these important engineering tools can be applied to some of your operations.

Now that we are at the end of 1958, this is a good time to take a good look at your present production equipments and methods, with the idea of making your plant modern and efficient as possible. For the demand for improvement and innovation must always persist in the successful company.



GEN-FLO TEST DATA—LOT NO. 1189—MN 58

TEST	SURFACE TENSION	Ph	% COAGULUM	VISCOSITY	FREEZE THAW	TOTAL SOLIDS CONTENT	MONOMER CHARGE RATIO	RESIDUAL STYRENE	SPECIFIC GRAVITY	MECHANICAL STABILITY	PARTICLE SIZE	
O. K.	✓	✓✓ ✓✓	✓	✓	✓	✓✓	✓	✓	✓	✓✓	✓	✓
FAIL												
INITIAL	JK	em dmk ma SK	SK	me	BV	HP QP	DZ	DH	SP	JR MS	RK	CHA
DATE	10/15	10/15 10/15 10/15 10/15	10/15	10/15	10/15	10/15 10/15	10/15	10/15	10/15	10/15 10/15	10/15	10/15

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PVP-128

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your business grow in these growing markets

New and bigger markets call for new and better materials. Here are three markets where coatings formulations based on BAKELITE Brand Plastics have a bright future. Make sure your coatings are equipped to move into growing fields like these. Learn how BAKELITE Brand Resins can give you a broader base for sales . . . an increase in profits . . . a saving in production. Get complete information and technical assistance from Union Carbide Plastics Company. As a start, mail the coupon below.

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Division of Union Carbide Corporation
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- H.D. THIEBEN, DETROIT, MICH.

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(INSIDE STORY)

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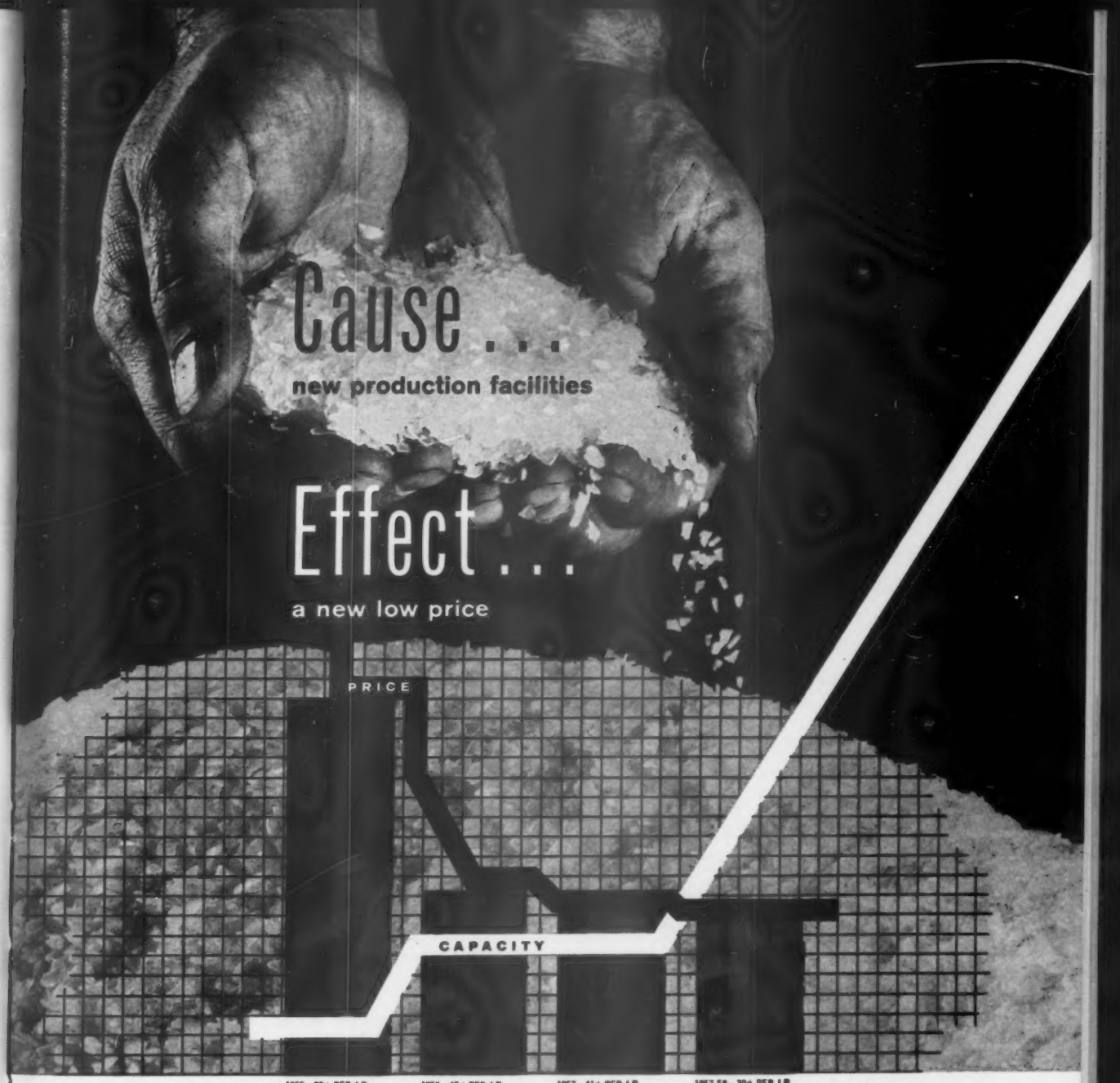

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Aviation	Plastics
Building	Surface Coatings
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NOW you can formulate your Nitrocellulose Lacquers with Epoxidized Oils

Research by Du Pont's new Sales Development Laboratory has produced lacquer formulations based on nitrocellulose, epoxidized oil, and urea formaldehyde resin.

Lacquers made in this new way retain the toughness, durability, ease of rubbing and repair, depth of gloss and color, and the economy traditionally contributed by nitrocellulose plus chemical resistance and good adhesion, even to unprimed metals.

A change in your present formula to include commercially available products will greatly improve adhesion and cold check resistance. The improvement in the latter property permits the use of lower viscosity nitrocellulose and an increase in solids. Such lacquers can be cold-sprayed at 28% solids or higher.

Pigmented or clear finishes are possible. Color stability is good. The new finishes can be brushed, sprayed, or dipped. Merely air-drying brings out these improved physical properties, while the use of a catalyst followed by a low-temperature cure produces solvent and chemical resistance superior to low-bake alkyds.

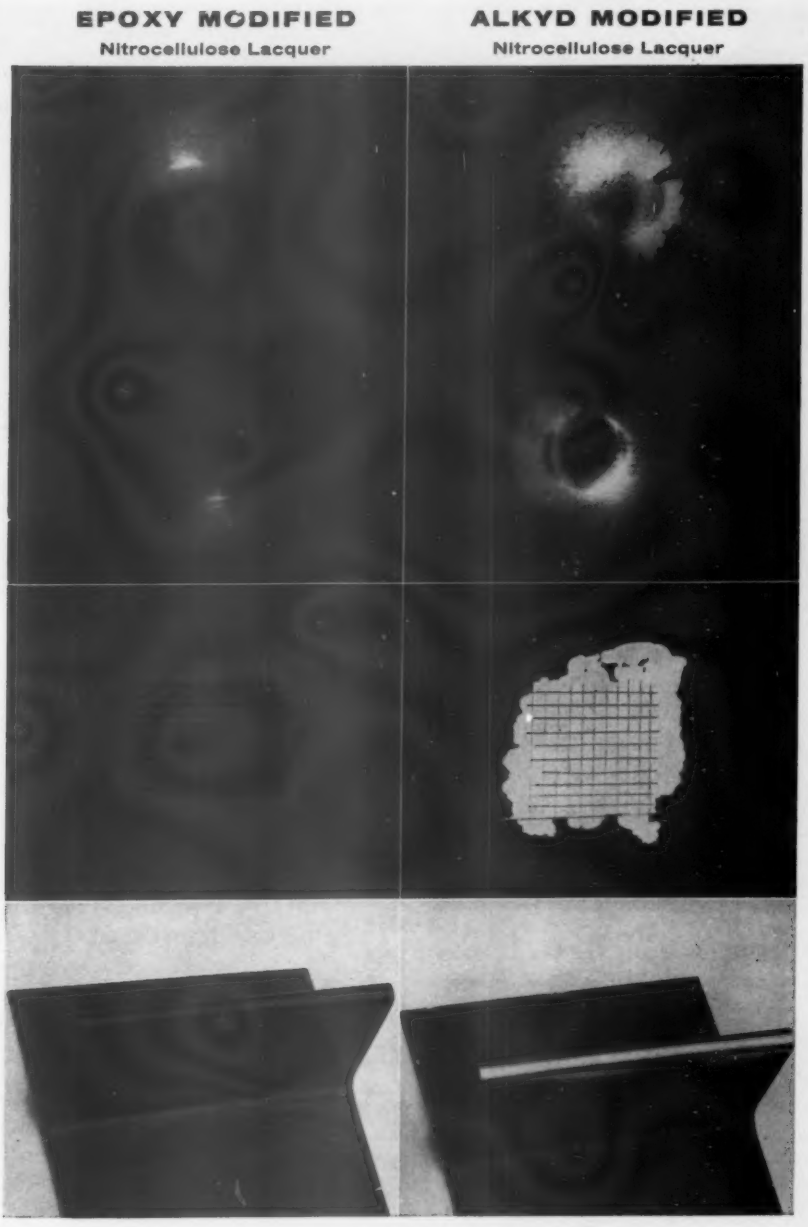
If you are interested in making a change to this new epoxy-modified nitrocellulose lacquer system, Du Pont will gladly send you a technical bulletin which describes this new development in detail.

For further information write to E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Chemical Sales, 2543 Nemours Building, Wilmington 98, Delaware.

DU PONT REG. U. S. PAT. OFF. **DU PONT**

BETTER THINGS FOR BETTER LIVING...

Tests with unprimed aluminum strips show the superior adhesion and durability of epoxy-modified nitrocellulose lacquer (left) made by new technique.



NITROCELLULOSE

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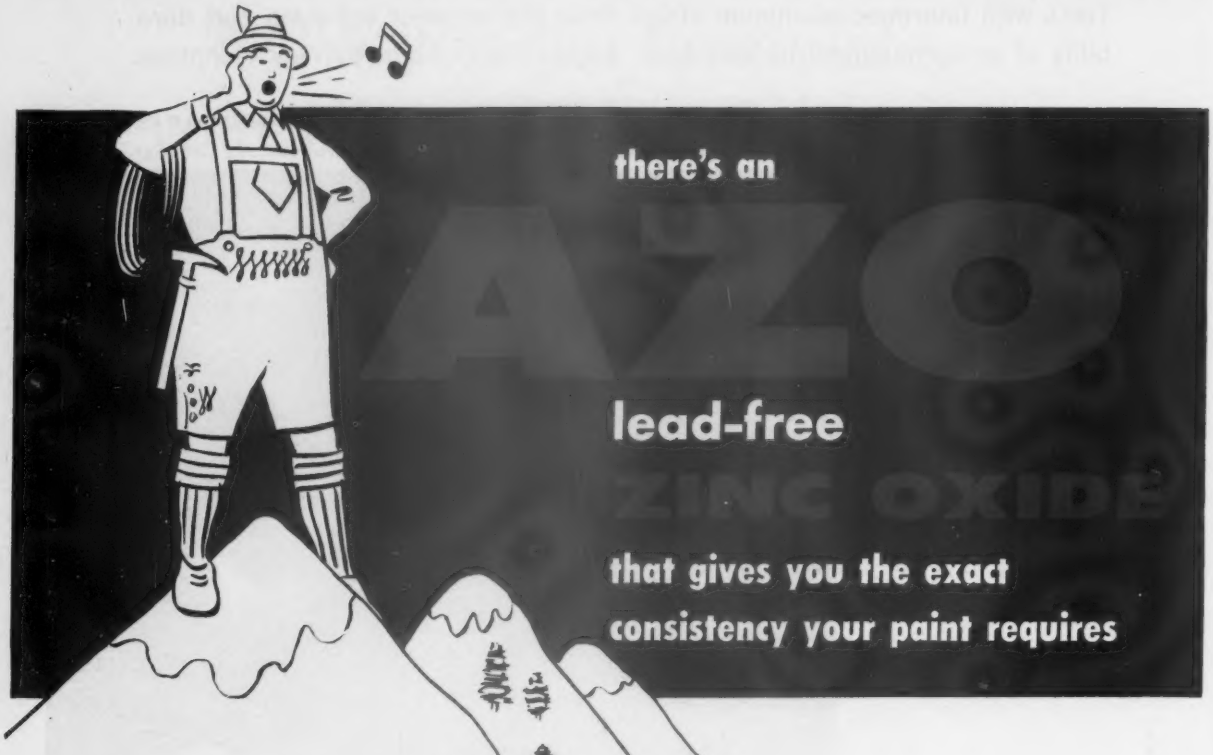
From the HIGHEST to the LOWEST



OTHER GRADES OF AZO ZINC OXIDES IN A WIDE RANGE OF OIL ABSORPTIONS

Where necessary to meet your requirements we can select within grades the *exact* degree of desired oil absorption.

NOTE: AZO paint grade zinc oxides available as AZODOX (de-aerated). AZODOX has twice the apparent density, half the dry bulk of conventional oxides.

1ST

American Zinc was the first, *and is still the only* producer of acicular lead-free zinc oxides covering a wide range of oil absorptions from high to low *and including the intermediate ranges.*

For Example:

When high consistency is wanted, use...

AZO ZZZ-22

This is the original high oil absorption acicular zinc oxide. The unusual weathering properties imparted to paints by AZO acicular type zinc oxides are present to the highest degree in AZO ZZZ-22.

When very low consistency is wanted, use...

AZO ZZZ-55 or AZO ZZZ-55-LO

Highly recommended for general paint formulations where very low oil absorption zinc oxide is desired. Absence of colloidal fines assures good weathering characteristics. Round particle shape.

American Zinc sales company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY
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Merry Christmas
FROM ALL OF US AT
COLUMBIAN CARBO
COMPANY

With Shawinigan's new GELVA TS-66 you can now manufacture high quality full and semi-gloss paints. And Shawinigan offers thoroughly tested working formulations.

Gloss paints based on GELVA TS-66 do not require special additives. It is the sole vehicle, and compounding in regular emulsion paint equipment is easy.

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Paints formulated with GELVA TS-66 offer:

No loss of gloss by aging either in can or on the wall
High gloss—85-90% reflectance, 60° Head;
semi-gloss—55-60% reflectance, 60° Head
Washable with soap and water—no effect on gloss
Good hardness retention—film does not become tacky on washing
Paints have long shelf-life, are stable
Flexible, non-yellowing films
Plus all the other physical properties which go to make up a quality polyvinyl acetate based paint, such as good leveling and brushability, good pigment binding capacity and others.

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NEW YORK SAN FRANCISCO SPRINGFIELD

GELVA® *emulsions for paints*

SHAWINIGAN RESINS

PIGMENTS

Finest finishes need the color appeal provided by Glidden pigments. Zopaque titanium dioxide disperses more readily, imparts greater whiteness. Cadmolith and Mercadmolith colors are non-fading, non-bleeding—offer advantages found in no other reds and yellows. Use Glidden pigments to make your products stand out at the point of sale.

QUALITY Glidden PRODUCTS

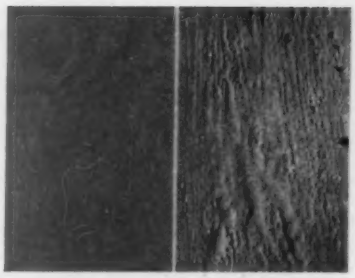
FINEST PIGMENTS FOR INDUSTRY

The Glidden Company
Chemicals—Pigments—Metals Division
Baltimore 26, Maryland

FOR EXTERIORS

. . . masonry buildings like this are easily and quickly coated with paints based on BAKELITE Brand Vinyl Latex WC-130. In addition to being easy to apply, coatings made with this material have been extensively tested for their ability to withstand weathering, sunlight, and fading. In the new-home construction field as well as the equally important maintenance market for older structures, there exists a good business potential for masonry paints that can offer the advantages of those formulated with WC-130.

Right over sealing tapes, paints based on WC-130 give today's drywall construction a smooth, clean coat. With ordinary paints, borax in tapes can be a handicap — forming brush-clogging particles that spread and spoil the finish. Made with WC-130, paints spread flawlessly and effortlessly, producing a perfect surface in record time.



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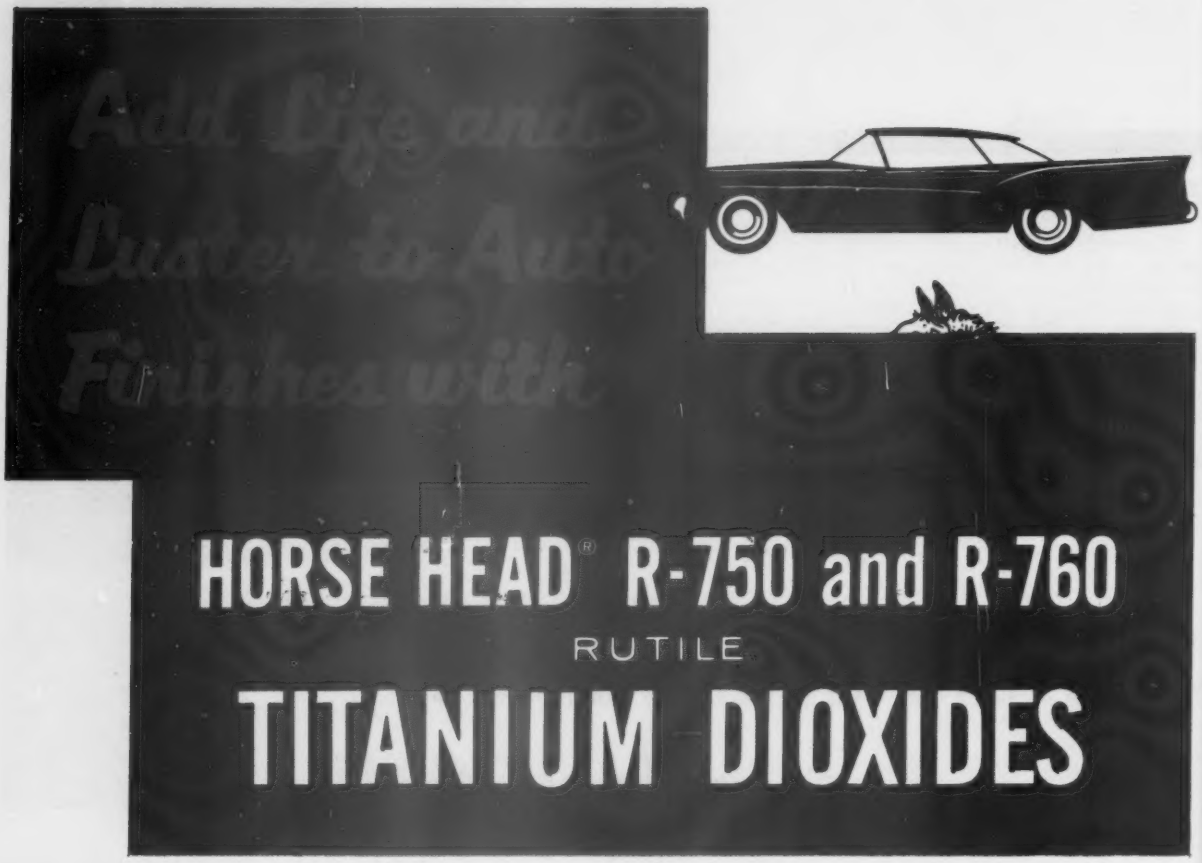

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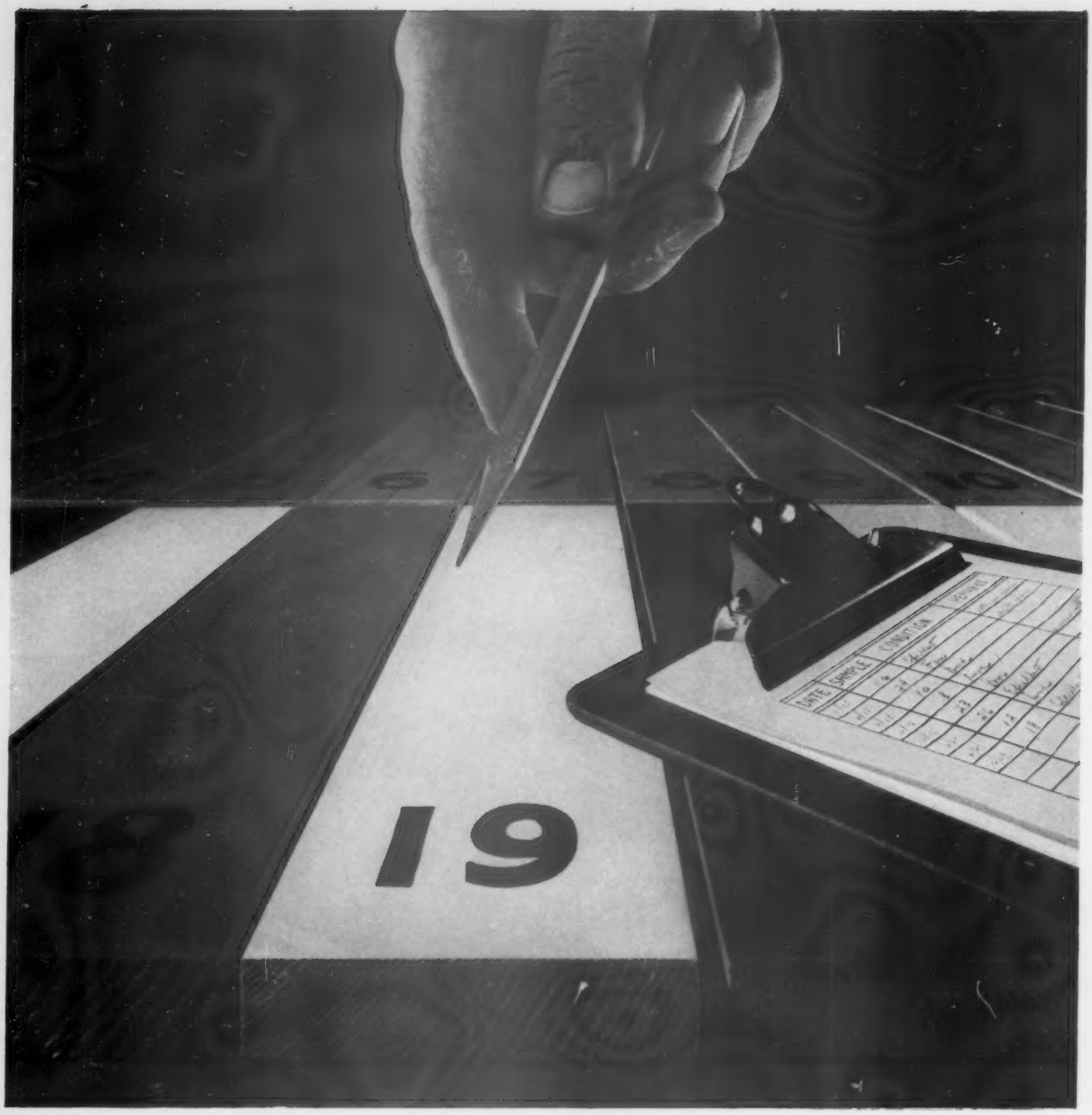

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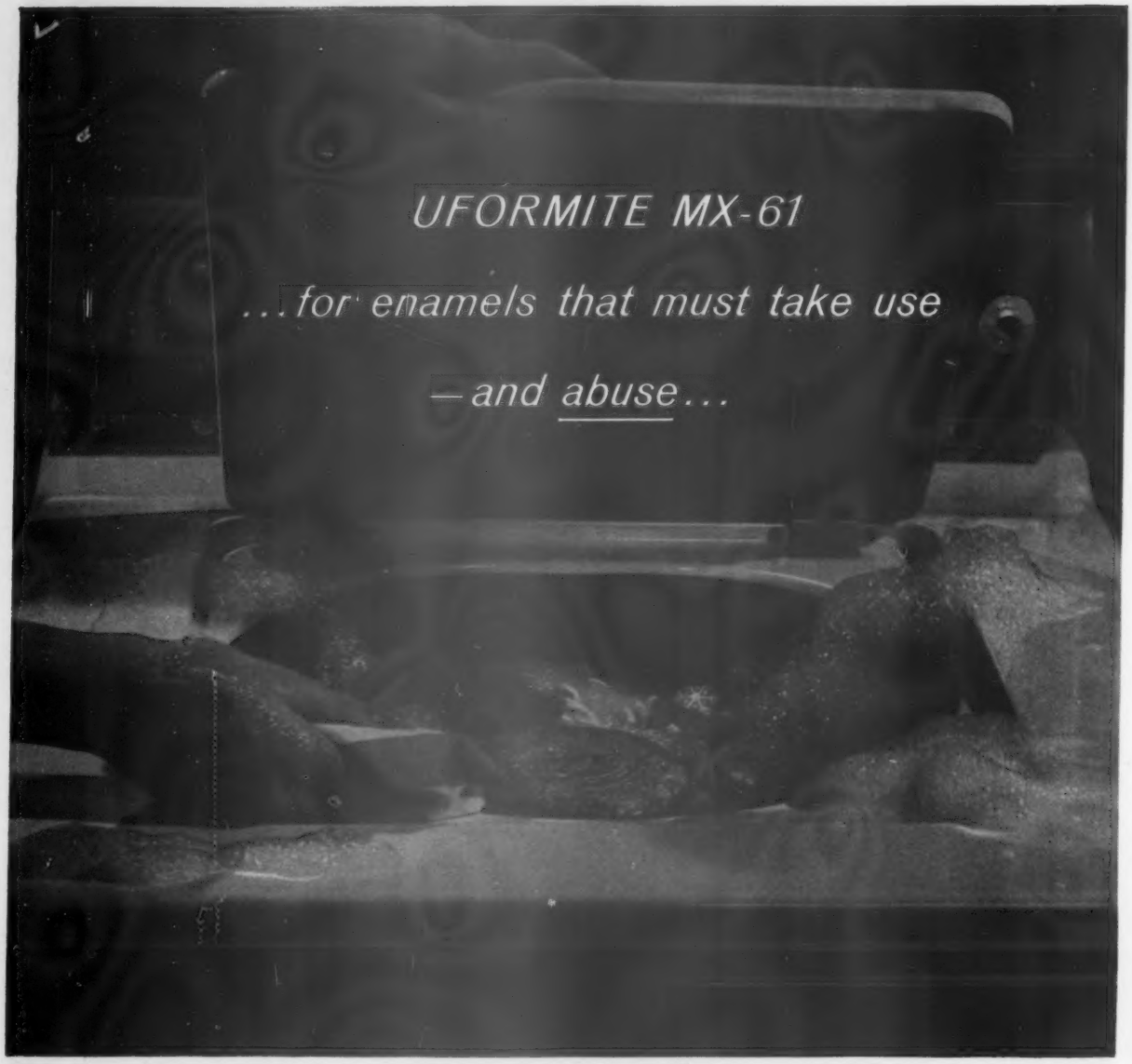

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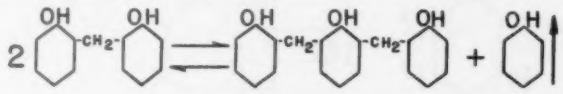
THERMAL INSTABILITY OF NOVOLAC RESINS

By
Howard E. Hoyt
H. W. Keuchel
R. B. Dean

NOVOLAC resins, prepared by the reaction of formaldehyde with phenol in the presence of an acid catalyst, are believed to be essentially linear polymers consisting of phenolic nuclei joined by methylene links at ortho and para positions (14,15). It has been shown that acid catalyzed novolacs contain no methylol groups (11,17) and that all the phenolic hydroxyls remain intact (1,12). In preparing these resins the condensation is carried out with an excess of phenol in order to minimize the possibility of condensing at all three of the reactive positions (two ortho and one para) on the phenol, which if it did occur would result in branching and eventual gelation through cross-linking. Thus only 0.7 to 0.8 moles of formaldehyde is used per mole of phenol in most preparative procedures, with 0.86 moles claimed as the maximum safe limit (12). This results in a thermoplastic resin with reactive positions available for cross-linking by further condensation when curing agents such as hexamethylenetetramine or other formaldehyde donors are subsequently added. It is for this reason that novolac resins are sometimes called two-stage resins. They are by definition relatively low molecular weight phenol terminated polymers which are heat stable and thermoplastic in the absence of curing agents (2).

Commercial Novolacs

Most commercial novolacs contain excess phenol (9,20) which may be removed by vacuum distillation. As the phenol is lost viscosity increases but levels off when all the free phenol has been removed. This behavior accords well with the theoretical structure and it is therefore disconcerting to find that some commercial novolacs continue to increase in viscosity when heated under conditions favoring the loss of phenol. In extreme cases certain resins were observed to gel when heated in open cups whereas other resins remained fluid. Since oxygen at high temperatures can cause the formation of an insoluble surface skin (9), test were modified by heating the resins in test tubes under vacuum in a slow current of nitrogen. As before, some resins frothed and gelled whereas others remained fluid. It was observed that additional phenol was given off when frothing and gelation set in, suggesting a disproportionation of the type:



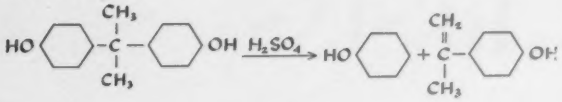
Equation 1.

Gelation and phenol liberation were found with resins which had been catalyzed with small quantities of sulfuric or phosphoric acids but not with resins which had been prepared with hydrochloric or oxalic acids. A resin prepared with sulfuric acid catalyst which was neutralized prior to stripping was stable in viscosity once the free phenol was removed. In a series of screening tests resins were heated in open aluminum foil cups on a 290°C. hot plate. Gelation occurred in 1 to 1-½ hours with resins catalyzed with 0.1% H_2SO_4 or 1.0% H_3PO_4 respectively. Resins catalyzed with 0.4% HCl or 1 to 2% oxalic acids

The Authors are associated with the Borden Chemical Co., Bainbridge, N. Y.

remained fluid and soluble for at least 3 hours. A non-gelling oxalic acid resin was gelled when heated with 10% of its weight of anhydrous $AlCl_3$. As might be expected, ortho cresol resins, even though catalyzed by sulfuric acid, remained fluid under these conditions since ortho cresol is difunctional.

Bisphenol A, which can be considered as a novolac with methyl groups substituted for the hydrogens on the methylene bridge between the phenolic nuclei, decomposed completely when heated with sulfuric acid to give a mole of phenol. The residue was an oil which may contain p-iso propenyl phenyl produced as follows:-



Equation 2.

Stability

An essential difference between stable and unstable resins lies in the degree of volatility of the acid catalysts used. Sulfuric and phosphoric acids will remain in the resin whereas both hydrochloric and oxalic acids could be lost when excess phenol is stripped from the resins. A commercial resin that had been catalyzed with 0.4% HCl was analyzed for Cl. Only 0.01% was found indicating that substantially all of the acid catalyst had been lost. Oxalic acid sublimes at 150°C. and has been observed in the condenser leading from a batch of oxalic acid catalyzed resin (16). Oxalic acid in novolacs may also decompose to CO, CO_2 and H_2O since these resins froth violently during stripping. An oxalic acid catalyzed resin was shown to be free of oxalate ion after the phenol had been stripped. It thus appeared that the presence of non-volatile acids catalyzed a disproportionation reaction which liberated phenol. As phenol was lost the molecular weight of the resin increased until gelation took place.

To test this theory an oxalic acid catalyzed resin B1 was prepared and thoroughly stripped of excess free phenol. The vaccum stripped resin, B2, was divided into three portions which were subjected to the treatments of the schematic, Figure 1.

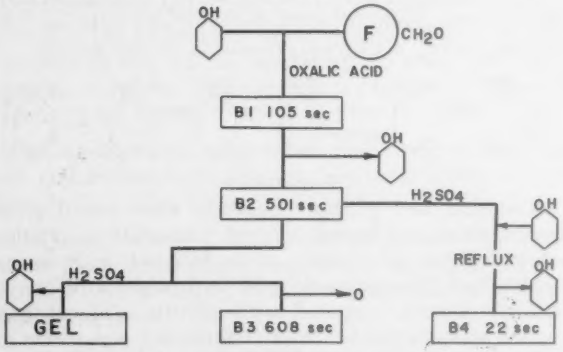


Figure 1.

Referring to Figure 1, the novolac B2 was substantially unchanged in viscosity and weight when further heated and stripped under nitrogen to give novolac B3. When it was heated with sulfuric acid under otherwise identical conditions it gelled with the evolution of 9.1 percent of its weight of phenol. Another sample of the stripped resin B2 was refluxed with excess phenol and a trace of sulfuric acid for 24 hours. It remained thermoplastic. The acid was then neutralized and excess phenol was stripped off at 200°C. under nitrogen at low pressure. The stripped resin B4 had increased 5% over the input weight of B2 and decreased to 1/25 of its original melt viscosity. The resin chains had evidently been broken by phenol which was incorporated into the resin, reducing the average molecular weight. Such a behavior indicates strongly that reaction 1 is reversible.

Experimental

Effect of Neutralization on the Stability of a Sulfuric Acid Catalyzed Resin

Resin A: 3000 g. of USP Phenol, 1500 g. of 37% formaldehyde solution (F/P mole ratio 0.58) and 3 g. of concentrated sulfuric acid were charged to a 3 necked 12 liter flask. The contents were refluxed for 4 hours until no formaldehyde could be detected in the distillate by hydroxylamine (19) (less than 0.2% CH_2O). Water was then distilled off to a temperature of 110°C. where the contents of the flask became homogeneous. The product, Resin A, had a pH of 3.6. It was divided into two aliquots. Part A1 was left untreated. Part A2 was neutralized with the theoretical quantity of sodium hydroxide to a pH of 6. The resins were vacuum stripped to remove water and excess phenol at 170°C. and 10mm. of mercury pressure. In the case of Resin A1 a slow evolution of phenol continued, whereas the neutralized Resin A2 reached an end point and no more phenol came over even when the pressure was reduced momentarily to 3mm. The resins were then cooled and crushed. Resins A1 had a viscosity of 44 seconds. Neutralized Resin A2 had a viscosity of 6 seconds. When subjected to the thermal stability test (see below) Resin A1 gelled in 14 minutes and lost an additional 4.6% of its weight as phenol. Resin A2 lost 0.0% weight in 66 minutes and remained unchanged in viscosity at 6 seconds.

Preparation of a Stable Oxalic Acid Catalyzed Novolac.

Resin B: 2400 g. phenol, 1645 g. of 37% formaldehyde solution and 30 g. oxalic acid were charged to a 3 necked 5 liter flask (mole ratio 0.794F/1.00P). The resin was brought to reflux and held until the distillate was free of formaldehyde. Water was then distilled off until the resin temperature reached 154°. An aliquot B1 was taken at this point. It had a viscosity of 105 sec. at 150°C. inclined plate flow (see below). Vacuum was then applied and a slow current of nitrogen was bubbled through the resin until the temperature reached 175°C. at a pressure of 6 mm. of mercury. Six percent phenol was removed. When no more phenol came over the resin was poured out into a pan, cooled and broken up. This was fraction B2 which had a melt viscosity of 510 secs. at 150°C. Stability was checked by the thermal stability test at 200°C. and 6 mm. Hg. The resin lost only 0.5% of its weight and the melt viscosity increased to 608 secs. at 150°C. (Resin B3).

Catalyzed Removal of Phenol from Resin B2

5.255 g. Resin B2 were treated with 0.009 g. H_2SO_4

(introduced as a solution in methanol) and subjected to the thermal stability test at 200°C. Under a vacuum of 6 mm. of mercury, 0.478 g. of phenol (9.1%) distilled off and the resin frothed and gelled. The gel was insoluble in acetone or alcohol. Phenol in the distillate had a melting point of 34-38°C., bromination showed 97.7% phenol.

Catalyzed Addition of Phenol to Resin B2

103 g. of Resin B2 were refluxed with 40 g. USP phenol and 0.37 g. sulfuric acid under a slow stream of nitrogen at 187°C. for 24 hours. The resin had a pH between 1 and 2 as indicated by a colorimetric test paper. The resin was cooled to 145°C. and 0.6 g. sodium hydroxide was added as a 50% solution raising the pH to 8. The resin was then stripped of phenol at 200°C. and 1 mg. mercury pressure. The crude product Resin B4 weighed 108.9 g. Correcting for the Na_2SO_4 and excess sodium as phenolate gives a net yield of 108.1 g. Resin B2 had, therefore, combined with 5% of phenol to produce Resin B4 which had a melt viscosity of only 22 seconds. B4 had the normal properties of a low viscosity novolac; it was soluble in alcohol and cured when heated with hexamethylenetetramine (hexa). (See Fig. 1).

Ortho Cresol Resin

This resin was made from a high purity commercial ortho cresol (Pitt Consol 99.6%, m.p. 30-31°C.) at a formaldehyde/cresol mol ratio of 0.876 catalyzed with 0.4 parts of sulfuric acid/100 parts cresol. The condensation was conducted under rigorous conditions at 194°C. for seven hours. Formalin was fed to the heated cresol while stripping off water under as efficient fractionating column. The crude resin had a relatively low melt viscosity of 111 seconds at 150°C. It did not cure with hexa on the 150°C. cure plate.

When this resin was stripped at 200°C. under 6 mm. pressure for 11 hours it failed to gel. Sulfuric catalyzed phenol novolacs gelled in about 10 minutes under this condition.

Pyrolysis of Bisphenol A

200 g. of commercial bishenol A (Monsanto) was heated in a 500 ml. flask with 8.5 ml. of 1 N H_2SO_4 at 30 mm. pressure under a slow stream of nitrogen. Water insoluble organic material appeared in the condensor at 130°C. pot temperature. Distillation was rapid at 143°C., slowed down at 180° C., and was taken to the dry point at 270°C. under 5 mm. pressure. 151 g. of crude phenol was recovered. The residue, unlike that from the acid catalyzed pyrolysis of formaldehyde novolacs, was completely thermoplastic.

The apparatus, Fig. 2, consists of a heated glass jar containing a high boiling resinous plasticizer, Paraplex U148, in which a 1" x 6" test tube was immersed with an inlet for a slow continuous purge of nitrogen and an outlet connected to a test tube of the same dimension which in turn was connected to a cold trap and vacuum pump. The bath was agitated by a mechanical stirrer. Parallel hookups were used for comparisons between catalyzed and uncatalyzed stripping to insure that time, pressure and temperature conditions were identical. Stripping was conducted

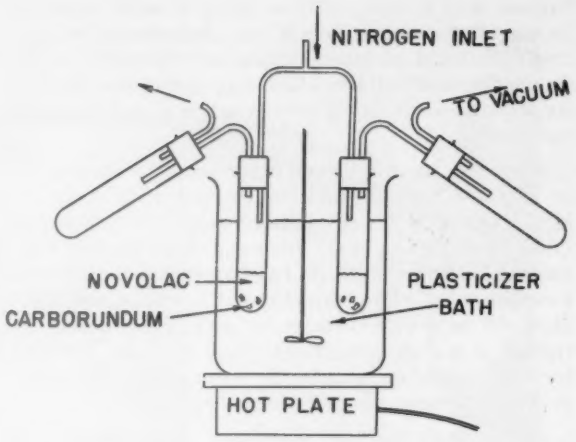


Figure 2.

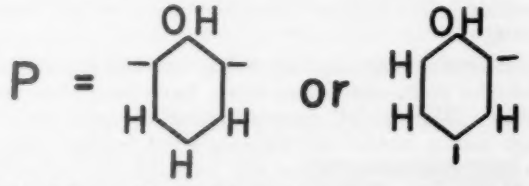
exhaustively at 200°C. bath temperature and 6 mm. Hg. pressure until no further distillate or no further weight loss occurred. Where gelation occurred, the end point apparent by a sudden violent frothing which almost filled the heated tube. Approximately 5,000 gram samples of crushed novolac were charged, together with a few grains of carborundum to insure steady boiling. Weight losses and weight gains were measured. Solid phenolic distillates were analyzed by the bromide-bromate method (18).

Melt Viscosity (Inclined Plate Flow)

This method is similar to that described by Jones (9). A one gram sample is melted on a grooved, polished hot plate which is then inclined to 10° from the horizontal. The time in seconds to flow over a 40 mm. course is recorded at the IPF viscosity. The plate is steam heated at a temperature of 150°C. for the lower viscosity novolacs, at 170°C. for the higher viscosity products.

Discussion

The increase in molecular weight of a novolac resin with loss of phenol upon heating with non-volatile acid can be considered as a special type of Friedel-Crafts alkylation where the alkylating agent is a substituted benzyl ion (phenyl carbonium ion) formed by rupture of the resin chain. Thus letting P represent a divalent phenolic nucleus:



and taking a diphenylol methane as a representative novolac for simplicity:

$$HP\cdot CH_2\cdot PH + H^+ \rightleftharpoons HP\cdot CH_2^+ + HPH$$

Equation 3.

$$HP\cdot CH_2^+ + HP\cdot CH_2\cdot PH \rightleftharpoons HP\cdot CH_2\cdot P\cdot CH_2\cdot PH + H^+$$

Equation 4.

In this reaction H^+ is the catalyst. Although $AlCl_3$ is the classical and frequently the best Friedel-Crafts catalyst, many other Lewis acids are also effective.

Sulfuric acid is recognized as being a useful catalyst for the alkylation of phenols (8). Substituted benzyl ions postulated as intermediates in this reaction are among the most reactive alkylating agents and phenols are recognized as being very reactive in substitution reactions.

According to this theory other strong acids should be effective if they could be retained in the resin at high temperatures. (Phosphoric acid is, of course, retained and is effective). The point could be tested by heating a novolac with HCl and an excess of phenol in a sealed tube. The conventional Friedel-Crafts catalyst $AlCl_3$ is also effective in anhydrous resins although it is of minor interest since it cannot be used for resin formation because the water of reaction which is always present would destroy the catalyst.

The overall reaction (equation 1) resembles the reversible trans-esterification which takes place when polyesters containing a volatile component are distilled. For example, Flory (5,6) found that excess glycol could not be stripped from a linear polyester without increasing the molecular weight of the remaining polymer by splitting out glycol between chains.

The reversibility of the Friedel-Crafts alkylation reaction is well known. The best example being perhaps the recycling of polyethyl benzenes in the production of ethyl benzene (4,7). Diethyl benzene, formed as a by-product when benzene is alkylated with ethylene, reacts with additional benzene to form two moles of ethyl benzene. Diethyl benzene is therefore an alkylating agent for benzene.

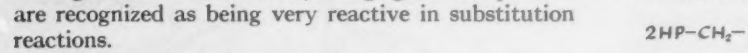
As with any reversible reaction, removal of one component favors the reaction which produces more of that component and its attendant co-product. Thus when phenol is removed from the resin the remaining molecules are rearranged to a higher $-CH_2-$ to phenol ratio. Since phenol is tri-functional, the resin will gel when this ratio exceeds unity.

The fact that ortho cresol resins failed to gel when heated for long periods with sulfuric acid catalyst is evidence that gelation proceeds through the third reactive positions (ortho or para) on the phenol nucleus and does not involve the phenolic hydroxyl group. The lower limit of temperature for the observed disproportionation with loss of phenol from novolac resins appears from our work to be about 150°C.

Analogous reactions involving transalkylation of phenylol methanes and novolacs have been observed before. Martin (13) quotes Bender as saying that a high boiling phenol will displace a low boiling phenol from a novolac but does not mention the catalytic effect of non-volatile acids. Carpenter and Hunter (3,13) found that in the presence of a trace of acid a methylene linked tetra phenolic compound would react with boiling para cresol to yeild diphenylol methanes. In our notation:

Equation 5.

The Rottlerone change (3,13) whereby an unsymmetrical polyhydroxy diphenyl methane is converted to a pair of symmetrical products, is catalyzed by acids or alkalies



As would be expected, resinous by-products are common. All of these reactions appear as examples of the general reversibility of the reaction between phenylol methanes and phenols in the presence of acid catalysts.

The rapid decomposition of bisphenol A when catalyzed with sulfuric acid is analogous to the well known reactivity of tertiary alkyl halides in comparison with primary halides. The corresponding tertiary carbonium ion $HOC_6H_4C(CH_3)_2^+$ is more stable than the primary ion $HOC_6H_4CH_2^+$(10) thus favoring reactions similar to equation 3. The instability of bisphenol A in the presence of even traces of acid has been noted before notably by Britton (1).

The low stability of bisphenol A in the presence of acids would be expected to carry over to derived epoxide resins. We have found that epoxide resins based on novolacs have a resistance to strong sulfuric acid which is several orders of magnitude greater than the resistance of bisphenol A based epoxide resins. Details of this work will be presented in a subsequent communication.

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ACRYLIC COATINGS from ORGANIC SOLUTIONS

By
Gerould Allyn*

THE term acrylic is rapidly becoming familiar to paint chemists, paint production men, painting contractors and even to the householder because of the wide spread acceptance of acrylic emulsion paints for masonry and plaster surfaces.

Acrylic organic solution polymers, however, are less well known because they are used chiefly in industrial finishing and lose their identity in the finish on an electric heater or a piece of silverware, before they reach the ultimate consumer.

Acrylic solution polymers for protective coatings were first produced commercially in the 1930's and they filled important specialty applications for industrial finishes prior to World War II. However, only in the last few years have they found large volume uses for organic coatings. Their present rate of growth is extremely fast and the trend in rate of use is sharply upwards. One need only mention the new acrylic automotive lacquers to indicate the large present and future volume available for polymers of this type.

This rapid expansion in consumption of acrylic polymers has occured because of several important developments in this field. One reason is commercial development of a large scale method for the production of acrylate monomers which provides a continuous process at lower costs than were available earlier. Production processes for methacrylate monomers have also been improved and these monomers are now available at lower cost. In addition much progress has been made in synthesizing new solution polymers for the paint industry with these lower cost monomers. And finally these new and improved polymers at lower prices have stimulated coating chemists to do additional research in the use of acrylic resins and this has resulted in the development of new and useful formulations.

*Rohm & Haas Co., Philadelphia, Pa.

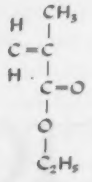
Acrylic and Methacrylic Monomers

Two types of monomers are available commonly referred to as acrylic monomers for the sake of convenience. These are the acrylate and methacrylate ester monomers. These monomers are the principal building blocks used in the polymerization of the various acrylic and methacrylic polymers.

A clear acrylic finish is being applied by spray to this large aluminum window frame.

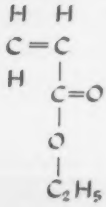
The properties of commercially available polymers depend to a large degree on the types and amounts of monomers used for their production. Consequently a brief review of the method of manufacture and the properties of the available monomers will be helpful to the paint chemist working in this field.

Methacrylic ester monomers differ in composition from the corresponding acrylic ester monomers because there is a methyl group attached to the alpha carbon in place of a hydrogen atom. Thus ethyl methacrylate monomer has the following structure:



Ethyl Methacrylate

By contrast ethyl acrylate monomer may be represented as follows:



Ethyl Acrylate

The ethyl group in each case is in the ester grouping. If a methyl group is used in each monomer in place of the ethyl group then the monomers are known as methyl methacrylate and methyl acrylate respectively.

Other long chain radicals can also be used in the ester group such as butyl, hexyl, octyl, lauryl and stearyl groups. For protective coatings the lower members of this series with one, two and four carbon atoms corresponding to methyl, ethyl and butyl groups are most widely used.

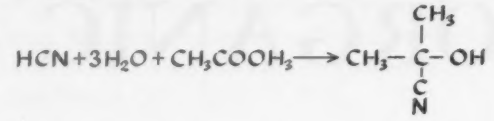
The side chain length of the monomer used for a particular polymer has a pronounced influence on the physical properties of the resulting polymer. When short side chain groups such as the methyl group are used for the monomer the resulting polymer tends to be hard, tack free, high in tensile strength and low in elongation. Substitution of longer groups in the side chains results in soft, tacky polymers with low tensile strength and great elongation.

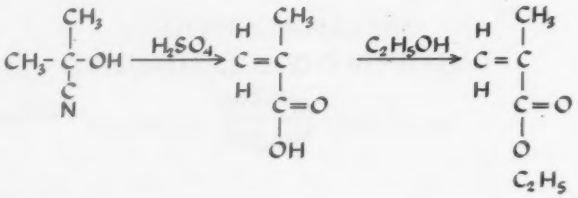
The methyl groups in the methacrylate polymers also have an important influence on the polymer properties. Methacrylate polymers, with ten carbon atoms or less in the ester grouping, are harder, and have higher tensile strengths and lesser elongation than the corresponding acrylate polymers. This increased rigidity is due to the presence of the methyl group on the alpha carbons of the main chain polymers.

Methacrylic Ester Monomer

Methacrylic esters, particularly methyl methacrylate, reached large scale commercial production before the acrylic esters because of the use of acrylic plastics such as Plexiglas†. This clear durable outdoor plastic is essentially polymeric methyl methacrylate. This polymer has achieved wide-spread commercial use in such diverse applications as plastic sheet for aircraft windows, school room windows subject to baseball hazards, durable outdoor signs and even contact lenses for eyeglasses, due to unrivaled clarity, color retention, toughness and outdoor durability. These are properties which are also useful in the protective coatings field. Hence the interest of paint formulators in similar polymers in organic solution form for industrial and consumer finishes.

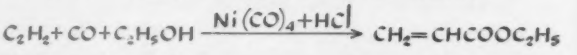
Methyl methacrylate monomer is made in a several step process made from acetone, hydrocyanic acid, sulfuric acid and methyl alcohol. These steps may be written in simplified form as follows:





Acrylic Esters

Early production of acrylic ester monomers was a complicated and expensive process starting with ethylene chlorohydrin and sodium cyanide. Following World War II, the Rohm & Haas Company developed a much more economical, one step process based on a reaction discovered by Dr. Walter Reppe in Germany. This process is a continuous catalytic process in which carbon monoxide, acetylene and an alcohol is passed through a catalytic converter containing nickel carbonyl and hydrochloric acid. The acrylate monomer produced depends on the choice of alcohol used for the reaction. Methyl alcohol for example produces methyl acrylate monomer while butyl alcohol produces butyl acrylate monomer. Chemically the process may be represented as follows:



Both of these reactions are shown schematically in Figure 1. For simplification in this article we shall refer to polymers of both acrylic and methacrylic esters as acrylic esters for the balance of this paper.

Polymers for Organic Coatings

Acrylic ester polymers for organic solution coatings are commonly prepared either by bulk polymerization or by solution polymerization. In the bulk polymerization method the desired monomers are polymerized in the presence of catalyst to produce solid polymers. These solid polymers are then broken in a crusher to small lumps and supplied to the paint manufacturer in that form. The chief advantage of the solid acrylic polymer is that the paint chemist has wide latitude in the choice of solvents used for the system. The

†Trademark registered U. S. Patent Office

SYNTHESIS OF ACRYLIC AND METHACRYLIC ESTERS
Steam
Natural Gas
Carbon Monoxide
Acetylene
Ethyl Alcohol
Catalyst
Ethyl Acrylate Synthesis
Fractionating and Washing
Ethyl Acrylate Monomer
Natural Gas
Air
Ammonia
Hydrocyanic Acid
Acetone
Acetone Cyanhydrin
Sulfuric Acid
Methacrylic Acid
Methyl Alcohol
Methyl Methacrylate Monomer

Figure 1.

solid polymers are usually dissolved in a shellac cutting barrel or high speed impeller type mill. However the solid polymers are relatively difficult to dissolve so that similar polymers in solution are often preferred.

These may be conveniently prepared from suitable acrylic monomers by using the desired solvent as a diluent in the reaction. This method is particularly convenient because it is easy to control the rate of reaction and the final polymer may be filtered, pumped and handled as any other paint vehicle. This method is particularly suited for the production of polymers with low and medium molecular weights. Very high molecular weight polymers are difficult to prepare by solution polymerization since they give very high solution viscosities.

It should also be noted that the percent of monomer polymerized and the molecular weight of the polymer depends on a number of factors. The molecular weight determines the viscosity of the solution so it is a important property. The factors which control molecular weight and resulting viscosity are the kind and amount of solvents used, the polymerization temperature and the presence of various catalysts and regulators. The influence of polymerization solvent on the viscosity of methyl acrylate polymers is shown in Table I.

Polymerization Solvent	% Conversion	Viscosity of the Polymer in Ethyl Acetate, secs.
Benzene	90	220
Ethyl acetate	88	122
Ethylene dichloride	88	90
Butyl acetate	86	1.4
Methyl isobutyl ketone	84	1.0
Toluene	82	1.0

Table I. Influence of polymerization solvent on the viscosity of methyl polyacrylate.

The value for percent conversion indicates the amount of monomer which is converted to polymer in the particular solvent. The viscosity given is a relative value only and is related to the molecular weight of the polymer. As can be seen the polymerization solvent has a very important effect on the molecular weight and the viscosity of the polymer produced.

Polymers from acrylic and methacrylic esters of shorter chain acohols are in general soluble in hydrocarbons, esters, ketones and various chlorinated solvents. The higher alcohol derivatives are soluble both in aliphatic and in aromatic hydrocarbons.

For a full discussion of polymerization variables with these monomers the reader should consult the complete work by *Dr. E. H. Riddle of the Rohm & Haas Comapny*, entitled "*Monomeric Acrylic Esters*" published by Reinhold Publishing Company in 1954.

Properties of Acrylic Ester Polymers

As indicated earlier the properties of acrylic (and methacrylic) ester polymers depend on a large degree on the chain length of the alcohol used in the manufacture of the monomer. For example a film of polymeric ethyl acrylate is tough, moderately hard and rubbery with an elongation of approximately 750%. The polymer of approximately the same molecular weight from ethyl acrylate is considerably softer, more tacky and more flexible than that produced from the polymethyl acrylate. The ultimate elongation of the polyethyl acrylate for example, is about 1800%. The corresponding lower alcohol methacrylate polymers in general are considerably more rigid, harder and show less tack than do the acrylate polymers.

The various acrylic and methacrylic monomers are generally compatible with each other and with many other types of monomers such as styrene, acrylonitrile, vinyl acetate, vinyl chloride and others. This makes it possible to prepare pure or modified acrylic type polymers in a wide range of flexibility, tensile and elongation characteristics. Plasticizers which must be used with many types of polymeric materials such as polystyrene are not needed with the acrylic polymers due to the flexibility which can be built in with the soft and extensible types. It is possible to produce tough and flexible films with excellent permanence without the use of volatile or fugitive plasticizers.

Use of Acrylic Polymers Solution Coatings

The major uses for the acrylic polymers in organic coatings depend largely on the following properties available in these resins.

1. Transparent water-white films.
2. Excellent resistance to discoloration from high temperatures, and ultraviolet light.
3. Resistance to water, alkali, acids and oils.
4. Minimum pigment reactivity.
5. Good resistance to burning.
6. Excellent resistance to chemical fumes.
7. Long film life and excellent flexibility under rugged outdoor exposures.
8. Good electrical properties.

Most of these polymers are thermoplastic in nature and are permanently soluble in suitable organic solvents. Much research effort is being directed towards producing good thermosetting acrylic polymers with all of the above properties. Some progress has already been made in this direction but much more needs to be done before thermosetting acrylic polymers find wide spread use in the field of organic coatings.

Organic solutions of acrylic polymers are handled in much the same way in the paint plant as are other solution vehicles. They may be used as clear finishes alone or with other modifiers or they may be pigmented with most conventional paint pigments due to their low pigment reactivity.

Relatively strong solvents are usually used for thinning acrylic paints. Some of these paints permit the use of xylol or toluol while others require ketone solvents such as methyl ethyl ketone. A few specialized acrylic coatings, chiefly for brush application, may be thinned with mineral spirits or turpentine. Strong solvents may lift previous coats of conventional paints so that special primers are often required.

Acrylic coating may be either air dried or baked. No oxidation is needed to form the film since they dry by solvent evaporation. This places these coatings in the category of the fast drying lacquer-type coatings.

Force drying or baking is often desirable, however, for industrial finishing both to speed up production

and to improve adhesion, gloss, and hardness. Application is generally by spray gun, aerosol spray, dip or flow coating. However, tumbling, roller coating and brushing are all used.

Acrylic paints cannot be mixed indiscriminately with other types of paints. As a rule they are compatible with vinyl and chlorinated rubber coatings but mixing is not recommended. They definitely are not compatible with oil paints, varnishes, or conventional alkyd paints. Tinting colors, unless specifically designed for acrylic paints, must not be added or streaking and gelation may result.

A great deal of basic information on the properties of the common acrylic polymers is now available due to a recent large scale laboratory study. This information includes a broad study of compatibility of acrylic ester polymers with each other, with other film forming resins and with various plasticizers. In this connection it should be noted that while practically all of the monomers of these various types can be readily inter-mixed the polymers have definite limits of compatibility. This is shown, along with other basic data in Tables II, III, and IV.

Properties of Clear Acrylic Finishes

Acrylic coatings for use as clear finishes are normally supplied at 15-20% solids. They are usually reduced for spray application with about a quart of thinner per gallon. For application by dipping, lower solids are often used.

The films set to touch in 5 to 10 minutes and dry tack free in from 10 minutes to one hour. Sward hardness is in the range of 20-30 units which means that the films resist scratching with the fingernail.

Good adhesion is obtained to brass, copper, aluminum, steel chrome plate, zinc die cast, and other metals. Films have excellent gloss retention. Two or more coats should be applied to bare steel to reduce the possibility of pinholing with subsequent rusting.

Clear acrylic films are thermoplastic and become tacky at temperatures near 200°F. However these films retain good color and recover their hardness on cooling. Flexibility is reduced at low temperatures but the films are not harmed. The mechanical and electrical properties of the unmodified polymers are given in Table V and Table VI. Additional details on film properties are given on the section on pigmented films.

Application for Clear Acrylic Finishes

Finishes for Hardware

Clear acrylic coatings are particularly useful as

Other	Per Cent Acryloid A-10			Per Cent Acryloid A-101			Per Cent Acryloid B-44			Per Cent Acryloid B-66			Per Cent Acryloid B-72			Per Cent Acryloid B-82			Per Cent Acryloid C10LV			Per Cent Acryloid F-10		
Components	10	50	90	10	50	90	10	50	90	10	50	90	10	50	90	10	50	90	10	50	90	10	50	90
A-10	—	—	—	C	C	C	C	C	C	I	I	I	C	I	SI	C	I	C	SI	I	SI	I	I	I
A-101	C	C	C	—	—	—	C	C	C	I	I	SI	SI	I	SI	C	C	C	C	I	I	I	I	I
B-44	C	C	C	C	C	C	—	—	—	C	SI	I	C	I	C	C	C	C	C	SI	I	I	I	I
B-66	I	I	I	SI	I	I	I	SI	C	—	—	—	C	I	C	C	SI	C	SI	SI	I	SI	I	I
B-72	SI	I	C	SI	I	SI	C	I	C	C	I	C	—	—	—	C	C	C	C	C	I	C	SI	I
B-82	C	I	C	C	C	C	C	C	C	C	SI	C	C	C	C	—	—	—	C	I	I	SI	I	I
C10LV	SI	I	SI	I	I	C	I	SI	C	I	SI	SI	I	C	C	I	I	C	—	—	—	I	I	I
F-10	I	I	I	I	I	I	I	I	I	I	I	SI	I	SI	C	I	I	SI	I	I	I	—	—	—

C—Compatible in dried film
SI—Slight incompatibility in dried film
I—Incompatible in dried film

Table II. Mutual Compatibility of Acrylate Resins.

Other Component	Per Cent Acryloid A-10				Per Cent Acryloid A-101				Per Cent Acryloid B-44				Per Cent Acryloid B-66				Per Cent Acryloid B-72				Per Cent Acryloid B-82				Per Cent Acryloid C10LV				Per Cent Acryloid F-10			
	90	75	50	25	90	75	50	25	90	75	50	25	90	75	50	25	90	75	50	25	90	75	50	25	90	75	50	25	90	75	50	25
Uformite F-200E	I*				I*				I*				I*				I*				I*				I*				I*			
" F-222	I*				I*				I*				I*				I*				I*				I*				I*			
" F-240	SI				SI				SI				SI				SI				SI				I*				I*			
" MM-47	I*				I*				I*				I*				I*				I*				I*				I*			
" MM-55	I*				I*				I*				I*				I*				I*				I*				I*			
" MX-61	SI				SI				C	SI			C	SI			SI				SI				I				SI			
Cellulose acetate butyrate ½"	C	C	C		C	C	C		C	C	C		SI*	SI	SI		C	SI	SI		C	SI	SI		C	SI	SI		I*	I*	I*	
RS nitrocellulose ½'		C	C			C	C			C	C			C	C			C	C			CC				C	C			C	SI	
Amberlac 292X		I*	I*	I*		I*	I*	I*		I*	I*	I*		C	C	C		I*	I*	I*		I*	I*	I*		I	I*	I*		I*	I*	I*
Vinylite VAGH		C		C		C		C		C		C		C		C		C		C		C		C		SI		I*		C		I
" VMCH		C		C		C		C		C		C		C		C		C		C		SI		SI		I*		I*		I*		I
" VYHH		C		C		C		C		C		C		C		C		C		C		SI		C		I*		I*		I*		SI
Exon 470		C		C		C		C		C		C		C		C		C		SI		C		SI		I*		I*		C		C
Ethyl Cellulose	I*				I*				I*				I*				I*				I*				SI				SI			
Dow DC-840		C	C			C	C			C	C			C	C			C	C			C	C			C	C			C	C	
Epon 562	C	C			C	C			C	C			C	C			C	C			C	C			C	C			C	SI		
" 1001	C	C			C	C			C	C			SI*	I*			SI*	I*			C	SI			SI	I			I*	I*		
Parlon 10 cps		SI	I			SI	I			SI	SI			C	C			SI	SI			SI	SI			I	I			C	C	
" 20 cps		I	I			I	I			SI	SI			C	C			SI	SI			SI	I			I	I			C	C	

C—Compatible in dried film
SI—Slight incompatibility in dried film
I—Incompatible in dried film
*—Incompatible in solution

Table III. Compatibility of acrylic resins with other film formers.

Other Component	% A-10		% A-101		% B-44		% B-66		% B-72		% B-82		% C10LV		% F-10	
	90	75	90	75	90	75	90	75	90	75	90	75	90	75	90	75
Raw Castor Oil	SI	I	SI	I	C	I	C	SI	C	SI	C	I	I	I*	C	C
Castor Oil (Bakers #15)	SI	I	SI*	I*	C	SI	C	C	C	SI	C	I*	I*	I*	C*	SI*
Dibutyl Phthalate (DBP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Dioctyl Phthalate (DOP)	C	C	C	C	C	SI	C	C	C	C	C	C	SI	SI	C	C
Dioctyl Sebacate (DOS)	C	I	SI	I	I	I	C	C	C	I	I	I	I*	I*	C	C
Dibutyl Sebacate (DBS)	C	C	C	SI	C	SI	C	C	C	C	C	C	I	I*	C	C
Butyl Benzyl Phthalate	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Tricresyl Phosphate (TCP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Aroclor 1254	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Paraplex G-25	I*	I*	I*	I*	I*	I*	C	I*	SI*	I*	I*	I*	I*	I*	I*	I*
" G-40	C	SI	C	SI	C	SI	SI*	I*	SI	I*	C	I	C	C	I*	I*
" G-50	C	C	C	C	C	C	C	SI	C	C	C	C	SI	I	I*	I*
" G-60	SI	I	SI	I	SI	I	C	C	C	SI	SI	I	I	I*	C	C
" G-62	SI	I	C	I	SI	I	C	C	C	I	SI	I	I	I*	C	C
Paraplex RG-2	SI*	I*	SI*	I*	SI*	I*	SI*	I*	I*	I*	I*	I*	I*	I*	C*	SI*
" RG-7	SI	I*	I*	I*	C*	SI*	I*	I*	SI*	I*	SI*	I*	I*	I*	I*	I*
" RG-8	SI*	I*	SI*	I*	SI	I*	C	SI*	C	SI*	SI	I*	I	I*	C*	C*
" RG-10	SI*	I*	SI*	I*	C*	I*	SI*	I*	C*	SI*	SI*	I*	SI	I	SI*	SI*
Monoplex S-70	SI	I	SI	I	I	I	C	C	C	I	SI	I	I	I*	C	C

C—compatible
SI—slight incompatibility
I—incompatible
*—incompatible in solution

Table IV. Compatibility of acrylic resins with plasticizers.

Grade	Tensile Strength lbs. Per Sq. Inch	Percent Ultimate Elongation	Toughness[1] Inch Pounds Per Cubic Inch
Acryloid A-101	4100	3	60
Acryloid B-72	2900	44	1000
Acryloid B-82	2900	77	2000
Acryloid F-10	2200	64	1200

[1] Values shown are the area under the tensile elongation curve

Table V. Strength of acrylic resin films.

Dielectric Constant	Acryloid A-101	Acryloid B-72	Acryloid B-82	Acryloid F-10
60 cycles	3.6	4.4	4.7	3.2
1000 cycles	3.2	3.7	4.1	2.8
10^6 cycles	3.1	3.1	3.3	2.6
30 x 10^6 cycles	2.3	2.6	2.9	2.3
Power Factor (%)				
60 cycles	7.1	9.6	8.8	9.0
1000 cycles	3.5	7.8	8.0	5.6
10^6 cycles	3.0	4.6	5.7	2.3
30 x 10^6 cycles	27.5	6.8	9.8	9.5

Table VI. Electrical properties of acrylic resin films.

protective finishes over polished metals, such as brass, chrome plate, silver and aluminum. The coating may be almost invisible because of its clarity, but it serves a vital function nonetheless. Brass or bronze articles lose their sparkle quickly unless the surface is protected from air and moisture. Unprotected silverware, candlesticks, trophies and plaques quickly turn brown from sulfide fumes. Acrylic finishes applied by the fabricator provide excellent protection to silver surfaces against such staining. The familiar aerosol spray cans which are widely sold for household use are often formulated from acrylic resins. While these compositions are quite low in solids they are very convenient to use and provide excellent protection to the metal surfaces listed above.

Aluminum Finishes

Clear acrylic finishes, often known as methacrylate lacquers, are used in the manufacturer of aluminum window and door frames, storm sash and other structural shapes. During erection of the building, aluminum surfaces are likely to be placed in contact with fresh mortar. Furthermore plaster, stucco or concrete etching acids may be splashed on the surfaces. Under these conditions aluminum discolors, due to corrosion of the surface. An acrylic coating protects the aluminum from staining by alkaline mortar or plaster, or by acid. Furthermore, the coating reduces adhesion so that mortar accidentally splashed on the surface may be removed readily. Finally the coating will give protection for a year or more during the erection of very large structures.

In some cases coatings of this type have been found to provide a bright, corrosion free surface for four or five years. It is quite easy to test acrylic coatings for the application. Small quantities of lime and freshly mixed mortar are placed on coated aluminum panels. The panels are placed in a humidity cabinet operated at 100° F. and 100% relative humidity for 7 days and 30 days. A satisfactory coating will not be affected by this exposure and mortar or lime will not adhere strongly. Acid resistance is tested by immersing the panels in 10% hydrochloric acid for 6 hours.

The coatings must also show satisfactory resistance to 500 hours in a Weather-O-Meter, 600 hours in a salt spray cabinet and 500 cycles on a Taber abrasion resistance tester.

Vacuum Metallizing

The field of vacuum metallizing is one in which acrylic coatings have played an important part. In this process very thin coatings of the desired metal are vacuum-deposited on plastics, base metals or other surfaces. A great many items such as auto horn buttons, knobs, trademark emblems, refrigerator handles and radio parts are decorated with this process. Acrylic coatings provide a satisfactory base for the metallic deposit and also a top coat to protect the thin metal layer from damage during fabrication or use. These coatings may be applied either to the front or the back surfaces of the object.

The coatings may be clear, pigmented, or may be treated with transparent dyes. Interestingly enough

the vacuum metallizing process first attained wide use in the decorating of acrylic plastics, materials related to the acrylic coatings. More recently the availability of suitable organic finishes has lead to the adoption of vacuum metallizing for other plastic materials. This process is faster and much less expensive than electroplating although outdoor durability is not as good.

Almost any desired effect can be obtained, from a bright mirror-like chrome plate finish to a range of metallic colors since the metal may be covered with a tinted topcoat. Costly grinding, buffing and polishing operations needed for electroplating are eliminated, for the base coat eliminates most surface defects.

Electrical Equipment Coatings

Manufacturers of electronic equipment often use acrylic spray coatings to coat delicate equipment immediately after fabrication. Coatings are thus provided with resistance to moisture, dilute acids and high humidity. This insures military and civilian equipment against breakdown under tropical humidity and preserves delicate calibrations of capacity and resistance in complicated electronic circuits.

Manufacturers of television sets have found acrylic sprays very useful in the assembly of television sets. These coatings applied to the high voltage leads of the set eliminate corona, a frequent cause of "snow" on the screen. The largest communication system in America uses a clear acrylic coating to seal finished cable splices for both underground and overhead lines. The resistance of the coatings to moisture and weather assures long trouble-free service.

Coatings for Records and Foils

One very important application for these clear sprays is the preservation of office records. The name, birth date, and account number of every person registered under the Social Security Act are recorded on separate strips of thin wood covered with paper. These records, in the Bureau of Old Age and Survivors Insurance at Baltimore, are coated with clear acrylic spray to protect them during the individual's lifetime.

Engineering firms and military officers use a similar spray in aerosol form to protect blueprints, documents, charts and maps from rainfall, dirt and handling when these are taken into the field. There is a military specification covering this use. This is Specification MIL-C-12599 (ORD) for clear acrylic coating in a pressurized (aerosol) dispenser.

Acrylic coatings are also used by converters of aluminum foil. These coatings provide ultra-thin, clear protective finishes to preserve the shiny surface. Or the coatings may be dyed with transparent dyestuffs to give colored aluminum sheeting for novelty effects in packaging.

Chrome Coatings

Shortages of nickel often plague electroplaters in their production of high quality chrome-plated articles. The usual technique is to plate the steel first with copper, then with nickel, and finally with chromium. When nickel is unobtainable, this intermediate layer must be omitted and the finished job does not provide very good resistance to rusting. A clear acrylic coating, applied over the finished chrome plate by the manufacturer, gives added durability outdoors. Automobile manufacturers have used this type of coating extensively for coating chrome-plated bumpers when nickel was unobtainable. Similar coatings are used on brass hardware and over gold leaf to protect against discoloration.

Closely related to the clear chrome finishes are the temporary coatings used by electroplators. These are known as stop-off coatings. Their purpose is to provide electrical insulation on areas which should not receive a coating of metal during the metal plating process. Such coatings must be highly resistant to the acid baths often used for electro-plating. Since they are clear, the electroplater can see any changes which might take place under the coatings.

Decals are often applied to finished machinery to provide operating instructions, trademarks, name plates or simply for decorative effect. Clear, practically invisible acrylic coatings, sprayed over the decals preserve their bright colors and keep them clear and legible after the machine is in service. Decals last much longer out-of-doors when they are protected in this fashion.

Pigmented Acrylic Ester Coatings

General Properties

Acrylic resins are well suited as the base for pigmented enamels. Since the acrylic resins have excellent color retention, coatings stay white even at elevated temperatures. This is particularly important for industrial coatings on such items as electrical heaters, kitchen stoves, hospital sterilizers and fluorescent lighting fixtures.

In the production of such enamels a pigment to vehicle solids ratio of 40:60 is often used for white coatings. The pigment is usually all rutile titanium dioxide. For maximum opacity a 50:50 ratio can be used but the gloss will be somewhat lower than with the lower pigmentation. These enamels can be ground on a roller mill or in a pebble mill as desired. Care should be taken to get as good a grind as possible as the acrylic ester polymers are not particularly good pigment wetters.

A typical formulation for an acrylic ester white enamel is the following:

White Enamel Formulation with Acrylic Resin

Roller Mill Grind	POUNDS	GALLONS
Titanium dioxide	194.0	5.5
Acrylic ester resin (40% solids)	129.3	15.9
Mix With		
Acrylic ester resin (40%)	598.0	73.9
Xylol	34.0	4.7
	955.3	100.0
Physical Constants		
Weight per gallon	9.6 lbs.	
Total solids	50.8%	
Pigment	40%	
Binder	60%	

This enamel may be reduced with toluol or xylol to spray viscosity. For best flow a mixture of 3:1 xylol: Cellosolve acetate may be used for reduction. Solids at spray viscosity are about 32% and the viscosity should be about 15-18 seconds in a Ford 4 cup.

Property	Acryloid A-10	Acryloid A-101	Acryloid B-44	Acryloid B-66	Acryloid B-72	Acryloid B-82	Acryloid C10LV	Acryloid F-10
Initial solids, %	36.1	40.6	42.0	47.5	43.8	43.8	52.5	43.0
" viscosity (Ford #4 Cup)	70"	69"	70"	64"	69"	70"	34"	67"
Spray solids, %	26.3	21.0	26.6	32.7	26.8	27.8	40.4	26.4
" viscosity (Ford #4 Cup)	15"	11"	15"	15"	15"	15"	15"	15"
Hardness (High values better)								
Tukon 180°F - 30 mins.	20.5	20.5	18.2	14.0	10.4	11.7	.72	2.9
" 300°F - 30 mins.	31.5	31.8	21.7	16.3	14.4	15.0	.78	3.3
Pencil 180°F - 30 mins.	2H	H	H	F	F	H	2B	B
" 300°F - 30 mins.	4H	4H	3H	F	F	H	2B	HB
Adhesion (Low values better)								
Microknife 180°F - 30 mins.	> 22	> 24	13.5	> 23	19.2	18.7	7.7	15.0
" 300°F - 30 mins.	16.1	12.4	5.1	9.3	6.0	5.4	5.5	9.2
Gloss—Photovolt								
180°F - 30 mins.	78	52	80	77	81	81	67	55
300°F - 30 mins.	83	67	81	83	80	81	68	73
Color—Original (Low values better)								
300°F - 30 mins.	6.2	6.5	7.0	7.0	6.5	7.0	7.8	6.5
Color—Overbake								
350°F - 16 hrs.	6.4	7.3	9.9	7.4	11.2	17.0	55.0	6.5
Print Resistance—2 lbs. sq. in. - 1 hr.—160°F.								
180°F - 30 mins.	none	none	medium	medium	heavy	heavy	v.v.heavy	v.v.heavy
300°F - 30 mins.	none	none	light	light	heavy	heavy	v.v.heavy	v.v.heavy
Flexibility—1/8, 1/4, 1/2 in. mandrel								
180°F - 30 mins.	failed	failed	failed	failed	failed	failed	ok	ok
300°F - 30 mins.	failed	failed	ok ¼"	ok ¼"	ok ¼"	ok ¼"	ok	ok
Mustard Stain—30 min.								
180°F - 30 mins.	1	1	cl. 2	1	4	8	10	5
300°F - 30 mins.	1	1	v. cl. 3	1	6	9	11	7
Lard Oil Softening Oleic Acid 50/50—16 hrs.								
180°F - 30 mins.	none	none	v. slight	slight	slight	v. slight	med. soft	dissolved
300°F - 30 mins.	none	none	none	slight	slight	v. slight	med. soft	dissolved

Table VII. Properties of white enamels made from acrylic resins.

If too high viscosities are used for spray application pinholing and feathering may result. Similar enamels may also be used for dip application with some solvent adjustments. Brushing is generally rather difficult for these acrylic ester coatings due to their high viscosities at high solids. Some grades, however, may be reduced with mineral spirits to give enamels with fair brushing properties.

A careful comparison has been made of one series of commercial acrylic ester polymers in a standard white formulation above. This study illustrates the range of properties available in these commercial polymers. Test results are given in Table VII...

As can be seen from Table VII the white enamels in this series varied from hard, to very soft and flexible depending on the polymer used. Print resistance, color retention on over baking and resistance to oils and stains was best with the harder polymers.

Modifications of Acrylic Coatings

Some very interesting modified acrylic films with excellent toughness, adhesion and color retention can be made by using the acrylic esters with other film formers. Among the film formers of particular interest are nitrocellulose, vinyl resins, a special modified alkyd resin.

This modified alkyd designated Amberlac 292-X makes possible the formulation of a very interesting series of modified acrylic coatings with excellent adhesion, flexibility and color retention. Film properties obtained in the 75:25 and 70:30 acrylic ester to alkyd ratio are most useful.

These film compositions have remarkable durability outdoors. In one study in a gray automotive coating on metal panels exposed at 45° South in Florida the 70:30 combination showed a gloss of 45 after two years exposure. By contrast a conventional nitrocellulose alkyd automotive lacquer had a gloss of only 9. Table VIII gives the film properties of a series of clear films of this type.

Note that the adhesion of the system increases sharply with only 10 per cent addition of Amberlac 292X. Adhesion reaches a maximum at the 25 per cent and 50 per cent levels. Mar resistance is low for all of these formulations. Neither nitrocellulose nor Vinylite VMCH are compatible with this combination, although they are compatible with the individual components.

Acrylic resins in combination with nitrocellulose also show some interesting properties. A great many different combinations of this sort can be made but one series is given in Table IX.

Compositions of this type are of interest in water-white furniture lacquers where maximum color retention is needed. The acrylic polymer has excellent color retention but the coating does not sand as well as coatings with high nitrocellulose content.

Another interesting series of coatings is produced by modifying the acrylic resins with the vinyl resins. Several vehicle combinations with the resulting film properties are shown in Table X.

Applications for Pigmented Acrylic Enamels

Enamels for Extreme Heat Resistance

Acrylic enamels modified with silicone polymers are of interest for installations operating at temperatures

Film Composition		Tukon	Knife	Film	Flexibility	Mar
Acryloid B-66	Amberlac 292X	Hardness	Adhesion	Length	1/8" Mandrel	Resistance
100	—	10.4	P	P	P	P
90	10	10.2	VG	VG	P	P
75	25	8.7	E	VG	F–	P
50	50	3.0	E	VG	G	P
25	75	2.3	VG	VG	VG	P
10	90	1.4	G	VG	VG	P
—	100	1.0	F	E	VG	P

Table VIII. Film properties of acryloid B-66 modified with amberlac 292-X (Baked 30' at 250°F.).

Clear Films	Tukon	Knife Adhesion		Flexibility			
Baked 1 Hour @ 180°F	Hardness	1 hr. @ 180°F	1/2 hr. @ 300°F	1 hr. @ 180°F	1/2 hr. @ 300°F	Solids	Viscosity
Acrylic Nitrocellulose DOP							
65/25/10	11.7	F	VG	P	F	28%	Z_2
45/45/10	14.4	F	VG	F	G	25%	Z_2+
40/45/15	11.9	G	VG	G	G	26%	Z_2+
50/35/15	10.4	G	VG	F	G	29%	Z_1+
48/33/19	8.0	G	VG	G	G	30%	Z_1
40/40/20	8.3	G	VG	G	G	30%	Z_1+

Table IX. Properties of acrylic nitrocellulose films.

Clear Films	Tukon	Knife	Film	Flexibility		
Baked 1 hour @ 180°F	Hardness	Adhesion	Length	1/8" Mandrel	Solids	Viscosity
Acrylic/VMCH/DOP						
85/15/5	7.8	E	G	G	36%	J
70/25/5	7.8	E	G	G	33%	J-K
50/40/10	11.2	E	G	G	30%	J
Acrylic/VMCH/Epoxy Plasticizer						
80/15/5	7.2	G	F	G	36%	J
70/25/5	9.5	G	G	F	33%	J
50/40/10	12.1	VG	VG	F	30%	J
Acrylic/VAGH/DOP						
70/25/5	10.0	P	P	P	36%	Q
50/40/10	11.3	G	G	G	30%	Q

Table X. Properties of acrylic vinyl plasticizer systems.

in the range of 300-500° F. Under these conditions oil-based coatings quickly decompose and turn brown, but acrylic-silicone enamels retain their color and film properties remarkably well. However, such coatings are considerably more expensive than unmodified acrylic coatings. Normally they are applied by spray and baked at schedules of about one hour at 400-480° F.

Metallic Finshes

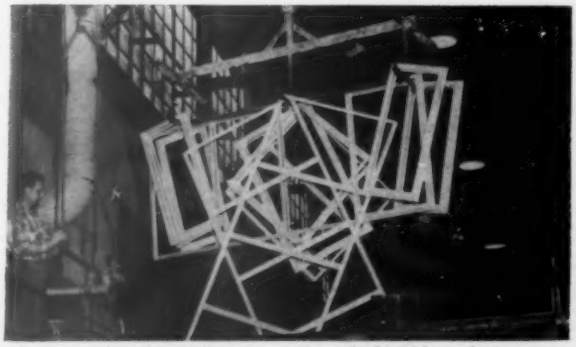
Some types of industrial finishes employ aluminum, bronze or stainless steel powders to simulate metallic surfaces. These finishes are often supplied in two-compartment cans for mixing by the user just before application. Ready-mixed compositions are also available. Acrylic resin solutions are often used as the base for these coatings since they are not reactive with powdered metals and do not discolor them.

Touch-up Paints

One interesting application of acrylic finishes is for aerosol touch-up enamels. Manufacturers of household appliances and industrial equipment often supply their service men with touch-up coatings in these containers. If by accident the finish on the appliance is marred during installation it is a simple matter to touch up the finish to its original beauty. The touched-up spots dry within minutes and the excellent appearance makes satisfied customers.

Chemical Resistant and Fume Proof Finishes

Acrylic finishes can be used very satisfactorily on machinery and equipment exposed to chemical fumes, fruit juices and the like. Modification with chlorinated rubber gives an unusually tough, resistant coatings. A rust inhibiting primer should be used for best adhesion.



Clear acrylic finish known as methylacrylate lacquer is applied to aluminum frames to provide protection against fresh alkaline mortar. The coating is held in a deep dip tank in the foreground and the sash are lowered into the coating by an electric hoist. A 10 minute air dry is sufficient to give a tack free coating.

Metal Decorating Finishes

Tough and flexible finishes for metal can be made with specially modified acrylic coatings. These coatings are applied to flat sheets of metal which are subsequently stamped or formed. These coatings

(*Turn to page 102*)

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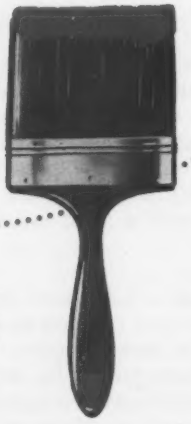

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By
Phil Heiberger

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

MUCH money and much effort are continually being invested in the business of prediction. Everyone seems to be preoccupied with calling the shots. This seems to be true in the fields of politics, fashion, business and finance, baseball, traffic accidents, physical and mental health, and almost any other area you can mention. Paint science and technology are no exceptions.


P. Heiberger

Paintwise, the accent is on outdoor behavior of the newer paints and paint intermediates at various locations throughout the country. Even these, however, are not perfectly dependable. Although it is recognized that moisture, oxygen, and ultraviolet radiation play major roles in film deterioration, nevertheless one is never completely sure how to use the few known facts for proper performance prediction and for superior product design.

The Air We Breathe

Part of the answer may well lie in the better understanding and control of air pollution. There has been a great deal of concern in recent years about air pollution and its effects on human health, particularly lung cancer, and for this reason alone it is a subject worthy of study. From the paint point of view, however, air pollution may also be important because of its influence on film deterioration.

There seems good reason to suspect that apparently erratic paint exposure and performance data may be explained by variety and intensity of air pollution. In other words, air pollution may play a more vital role in paint failure than has generally been recognized by paint scientists.

Air Conservation

In the October 17, 1958 issue of SCIENCE, in the article entitled "Air Conservation," A. J. Haagen-Smit discusses the general aspects of air pollution. A few pertinent highlights from this article follow:

The problem of keeping our air fit to breathe is a difficult one which promises to become even more difficult as time goes on. While today we are concerned with constituents present in concentrations of a few parts per million, in future with universal use of atomic energy pollutants will be present in quantities smaller by a factor of many powers of ten. Much theoretical knowledge and great technical skill will be required to clear the air of these pollutants.

Keeping the air clean is expensive. In the Los Angeles area alone it is estimated that several hundred million dollars have been spent already and many more will have to be spent before the smog will again be unnoticeable. The national expense will eventually run into billions of dollars.

Writes Haagen-Smit, "Perhaps we should even be grateful that in recent years air pollution disasters and near disasters have developed on such a scale that they have attracted the attention of the whole world (because they) have greatly inspired a more intensified effort to clean the air. . ."

What are the constituents of polluted air? Dust alone is certainly not the only undesirable agent. In fact, virtually all other constituents in flue gases—water, carbon monoxide, and oxides of sulfur and nitrogen—play some role. The sulfur and nitrogen oxides participate in a series of reactions leading to a gradual oxidation into sulfuric and nitric acids.

Investigations have shown that oxidation of sulfur dioxide takes

place slowly by photochemical action.

Of interest to us is the fact that the actual sulfur dioxide content is lower than the calculated amount but the difference is found as calcium and ammonium sulfate in dust settling. (Ammonium sulfate has been mentioned in various places as the cause of alkyd haze.)

Los Angeles smog is typified by a strong oxidizing action. A major part of the oxidant consists of ozone. This is responsible for excessive rubber cracking observed in the Los Angeles area. Various methods have established the presence of ozone concentration 20 to 30 times higher than those found in unpolluted air, where normal concentrations amount to 1 to 3 parts per 100 million.

"A simple and inexpensive method of measuring ozone involves the use of bent pieces of antioxoddant-free rubber as indicators. The time necessary for the appearance of the cracks is directly related to the ozone content of the air. At night, and on smog-free days it may take as long as an hour for the first cracks to appear; on a smoggy day, cracks are often evident in a matter of a few minutes, under the conditions of the test."

Continues Haagen-Smit, "Most organic compounds are relatively stable against oxidation, when completely pure, but the presence of peroxides speeds the auto-oxidation considerably through a chain reaction initiated by hydrogen removal from the hydrocarbon chain. This effect can be accomplished also through the action of light on either the hydrocarbon or the molecule. In the latter case, the excited oxygen may remove hydrogen. Most hydrocarbons do not have absorption bands in the wavelength region of sunlight for a direct photochemical reaction. Similar reactions can be accomplished in a roundabout way by having a substance present which accepts the light energy and subsequently transfers it to the compound to be oxidized. In nature we find such substances as chlorophyill and other photochemically active pigments. In polluted atmospheres nitrogen dioxide functions as an oxidation catalyst in this way."

Other factors cannot be overlooked either. For example in Los Angeles alone the automobile exhausts alone amount to as much as 1200 tons of hydrocarbons per day. Cigarette and cigar smoke contain from 300 to 1500 parts per million of nitrogen oxides (which is completely removed by inhalation.)

The interested reader is strongly urged to read the entire article for perspective and for more details. This problem will be with us for many generations, and the sooner we accept the inevitability of pollutants in the atmosphere the more realistically we can solve our problems.

Bothered by Pests?

IF you want to rid yourself of pests, that is, the household variety, you might reduce Ryugin Ito's Japanese Patent 6,450 (Chemical Abstracts *52*, 9628 (1950)) to practice. He claims a repellent paint useful for control of rates and insects and for moisture proofing by the addition of mercaptans to a resin solution.

It might be possible to carry this just one step further. Let's suppose, for the sake of argument, that you have the doubtful fortune of having a dull olfactory sense. Then this paint is made to order for you since it might also tend to keep away such two-legged pests as bill collectors, door-to-door salesmen, unwelcome relatives, neighbors, insurance agents and the like.

Polyurethane

POLYURETHANE in its numerous variations and modifications takes up quite a bit of our time. Fortunately for many of us, others find this chemical quite interesting in what often seems to me to be rather unexpected areas. For example, I found the following paragraph in the October 13, 1958 issue of *Chemical and Engineering News*:

"Polyurethane poured in liquid form into a fracture site bonds the ends of the bone. Plastic becomes an intimate part of the bone, then slowly dissolves, permitting the bone to grow together. Polyurethane is called Ostamer, is supplied by Wm. S. Merrell subsidiary of Vick Chemical."

A Rose By Any Other. . .

WITH all the acquisitions, mergers, and changes in corporate titles taking place these days, the poor consumer will be pardoned, he hopes, if he becomes slightly confused.

The recent announcement that the Bakelite Company has been reidentified as the Union Carbide Plastics Co. reminded me of a humorous item published in the May, 1958 issue of Alpha Chi Sigma's "Hexagon". To wit:

Now We Know

Business Ownership Change

THE following statement was circulated to customers, etc., on September 3rd by Huffer and Smith, Ltd., New Era Works, Purley Way, Croydon:

HUFFER & SMITH, Ltd.

"To avoid any confusion that may have arisen we write to inform you that:

"On July 22, 1957, Huffer and Smith, Ltd., manufacturers of fine chemicals, changed its name to Purley Way Chemicals, Ltd.: on the same date, a wholly owned subsidiary of C. F. Gerhardt Ltd., was incorporated with the name of Huffer and Smith Ltd.

"On July 23rd, 1957, Huffer and Smith Ltd. (the subsidiary of C. F. Gerhardt Ltd.) acquired all the assets and goodwill of the fine chemical manufacturers now called Purley Way Chemicals Ltd., and until July 22nd, 1957, called Huffer and Smith Ltd.

"The manufacture of fine chemicals previously carried on by Purley Way Chemical Ltd. (under its former name of Huffer and Smith Ltd.) is now carried on by Huffer and Smith Ltd., the wholly owned subsidiary of C. F. Gerhardt Ltd.

"Neither C. F. Gerhardt Ltd., nor Huffer and Smith Ltd., are in any way connected with Purley Way Chemicals Ltd., and all inquiries regarding accounts up to and including July 22nd, 1957, with that company under its former name of Huffer and Smith Ltd., should be referred to Purley Way Chemicals Ltd. Mr. H. H. Huffer is no longer connected in any way with Huffer and Smith Ltd., the subsidiary of C. F. Gerhardt Ltd."

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Changing to Standard Ultramarine Blues requires no major change in formulation procedure. Actually, your decision to use SUCo Blues can contribute to **improved** formulation.

This is definitely an advantage if your interest lies in aligning yourself with a domestic source of ultramarine blues, where **volume production** as well as laboratory facilities, sales and service are all centralized in relative proximity to your own plant.

Present users will testify to the superior quality of SUCo Blues—high strength, **rich, deep tones,** absence of free sulphur and excellent standardization—qualities inherent in SUCo Blues since production began in 1909.

Your inquiry, directed to the nearest field office or agent, or to the Huntington central office, will bring you samples and specifications promptly.

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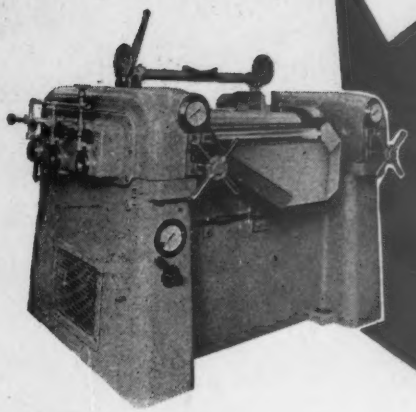
HUNTINGTON WEST VIRGINIA

BRANCH OFFICES AND AGENTS: Standard Ultramarine & Color Co., **Newark, Philadelphia, Chicago, New Orleans**—Standard Ultramarine & Color Co., Ltd., **Toronto** and **Montreal, Canada**—J. C. Drouillard Co., **Cleveland**—Thompson-Hayward Chemical Co., **Kansas City,** and Branches—Paul W. Wood Co., **Los Angeles** and **San Francisco**—L. E. Crossley, **Boston.** Also agents in other principal cities.

THESE MACHINES IN YOUR COMPETITOR'S PLANT

—can make things tough for you



Lehmann Model 662-V (also 661-V and 663-V) Sight-O-Matic Three Roll Mill. Also available with selective Float-O-Matic feature.

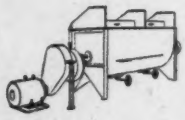
Lehmann Model 631-V (also 632-V) Sight-O-Matic Three Roll Mill.

The LEHMANN 631-V VERTICAL and the 662-V HORIZONTAL THREE ROLL MILLS with SIGHT-O-MATIC® CONTROLS definitely improve quality, increase output, and reduce costs wherever they are installed. If your competitor has this equipment, and you do not, you are, in effect, yielding him a strong competitive advantage.

Current buyers' markets are becoming more selective every day. The manufacturer who uses less than the best production equipment can be sure of one thing—the money he "saves" by not buying modern machinery he will lose many times over in higher operating costs and reduced business.

We suggest you send for complete information regarding Lehmann Roller Mills and other up-to-date milling equipment—learn what savings in time and money can be yours by installing Lehmann units in your plant to bring your operating costs down to rock bottom.

Lehmann would be pleased to offer milling research service on samples of your formulations, without obligation, and Certified Factory Reconditioning Service on your present equipment.



Lehmann's extensive line of equipment consists of: Vertical and Horizontal Roller Mills • Heavy-Duty Twin Paste Mixers • Sieving and Screening Machines.

Send for further information on any or all of the machines listed above.

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F

PRODUCTION

PACKAGING

MATERIAL HANDLING

NEW EQUIPMENT and MATERIALS

Inventories of finished products housed in the stock rooms of the Benjamin Franklin plant are controlled by punched-card methods. For details see page 81

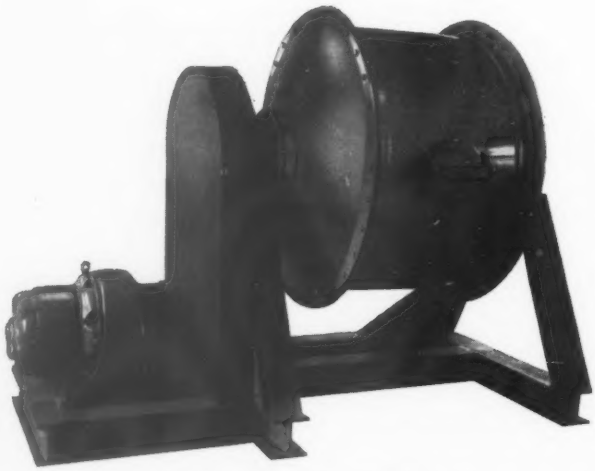
MODERNIZE your milling operations with "U. S." BALL and PEBBLE MILLS

12, 27 and 52 gallon sizes have one-piece grinding jar securely held by dome-shaped steel heads and heavy steel tie rods.

It pays to replace obsolete, inefficient equipment with dependable "U. S." Mills. In small laboratory batches or full production, you get easier, faster, more economical milling. Uniform results cut costs, assure better quality control.

Built for continuous, trouble-free service and ease of operation, sturdy "U. S." units have heavy welded steel bases, heavy-duty bearings and precision balanced grinding jars for smooth running under all loads. The Burundum-fortified grinding jars give up to three times the wear of conventional porcelain. Wide mouths speed loading and discharging.

87, 117, 158 and 210 gallon sizes have three-piece Burundum-fortified lining completely protected by steel casing.



Larger production units are available with grinding drums unlined, or lined with rubber, buhrstone, high density porcelain, or high alumina ceramic.

HANDY HINTS on Milling

A fast, easy way to clean your mill after wet or dry milling is by wet milling with a charge of flint sand and grinding media. After discharging, rinse mill with water.

For more helpful milling data and complete description of "U. S." Grinding and Mixing Equipment, WRITE FOR BULLETIN 280.

U. S. STONEWARE

AKRON 9, OHIO

PROCESS EQUIPMENT DIVISION

106-F

INVENTORY and PRODUCTION CONTROLS

Electronic data-processing equipment helps to keep inventories at optimum levels while doing other related accounting and statistical jobs at Benjamin Franklin's plant in Philadelphia.

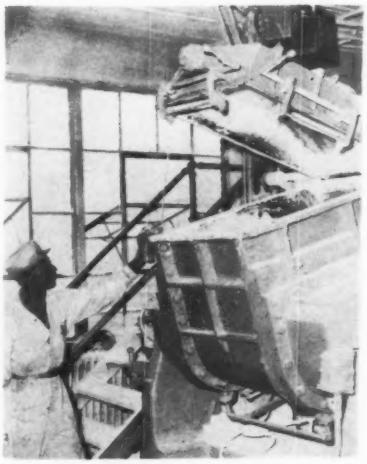
INVENTORY and production controls have always been important in the paint industry, but they take on increased significance today when America has become color-conscious to a degree that would have been unimaginable only a few years ago.

According to Harold Parker, plant manager of the Benjamin Franklin Paint and Varnish Company of Philadelphia, the trend toward use of color to accentuate home decoration, the sudden emergence of pastel and other bright-color finishes in the metal products field, the increasing use of color in school, factory and office—all these factors complicate the administrative problems of any paint manufacturer. He must keep his finished goods inventory light enough to insure flexibility in the face of shifting public tastes, yet deep enough to meet the demand for variety. Fortunately, the problem has come about simultaneously with the development of new ways to meet it.

Mr. Parker feels that electronic data-processing equipment is the logical answer. Intelligently applied, it cannot only help to keep inventories at optimum levels but can effectively take over a number of other related accounting and statistical jobs as well.

This has been the experience at Benjamin Franklin Paint and Varnish Company, a manufacturer of both consumer paint products and industrial finishes, with distribution throughout New England and the mid-Atlantic states. Prior to becoming one of the seven divisions of United Wallpaper, Inc. it was for some years a unit of a nationwide retail organization whose Philadelphia office handled most of the accounting and control paperwork.

Though practical experience with these procedures has therefore been relatively brief, it has managed



Production is carried out according to estimates based on sales figures for comparable bi-monthly periods of the previous year. The ball mill and dispersion mixer represent two production units used in the process.

Inventory and production control reports for Benjamin Franklin Paint and Varnish Company, Philadelphia, Pa., are prepared on the Remington Rand Univac 60 Punched-Card Electronic Computer (left and center), and Tabulator (right). The improved management control afforded by the method helps Benjamin Franklin to keep abreast of increasing need for controlled inventories of paint products.

to accomplish a great deal in a short time. The equipment used is a Remington Rand Univac 60 Punched-Card Electronic Computer, together with allied machines for punching, interpreting, reproducing, sorting and tabulating the punched cards with which it works.

Benjamin Franklin's production follows bi-monthly estimates based on sales figures for the comparable two-month period of the previous year. When these estimates, in the form of a thousand or so punched cards, are applied against other cards representing current inventory status, they give required production figures in the form of a tabulated report for the production department.

Every day, as orders come in, they are recorded in punched cards, matched with other cards from a master file, and fed to the computer, which automatically extends the cost and sales figures involved in each order. The extended order cards, when mechanically sorted into different sequences, then serve as the basis for an automatic tabulation of "pickers' tickets", or printed stockroom requisitions, and also for a tabulation of invoices.

Meanwhile, as items are produced in the factory to replenish stock, corresponding production cards are prepared in the tabulating room. Every week the Univac 60 computer automatically updates the inventory record on the basis of the week's sales and production activity.

Remington Rand Sorter is used to arrange punched cards in variety of sequences.

Working at milliseconds speed and with self-checking accuracy, it adds beginning inventory figures to those representing production, and subtracts sales to derive closing inventory; it also subtracts open orders from closing inventory to derive the amounts of each finished goods item currently available for sale. The cards resulting from this computer run are then tabulated into a concise printed report.

With this report on hand at all times, continually brought up to date, management has a clear picture of inventory, sales and production status at any given moment, and can thus make truly informed decisions.

Other accounting records such as depreciation of plant equipment and sales distributions are now prepared on this equipment and additional applications are in the process of development.

All indications for the future of the paint industry point to an increasing need for flexible inventories and close administrative controls, and to an increasing complexity of paperwork. At the same time the future of electronic data-processing promises increasing ease and efficiency in the handling of these requirements.

On the basis of our experience with both these developments so far, the Benjamin Franklin Paint and Varnish Co. can be confident of continued growth and success in the years to come.

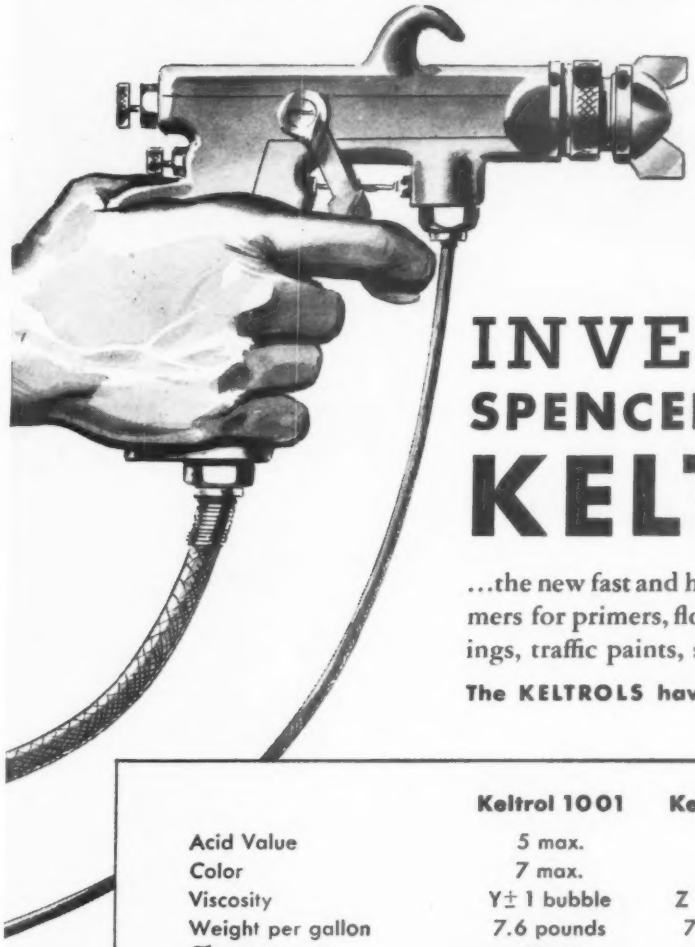
Studies conducted in the laboratory help the company to retain its position in consumer paints development.

Punched cards are prepared from daily sales orders on this Remington Rand Punch. The cards serve as the basis for automatic tabulations of invoices as well as stockroom requisitions.

KELTROL 1001 60% solids in Mineral Spirits

KELTROL 1013 60% solids in Xylol

KELTROL 1074 60% solids in V. M. & P. Naphtha



INVESTIGATE SPENCER KELLOGG'S KELTROLS

...the new fast and hard drying vinyltoluene copolymers for primers, floor sealers, enamels, paper coatings, traffic paints, special caulking compounds.

The KELTROLS have the following characteristics:

	Keltrol 1001	Keltrol 1013	Keltrol 1074
Acid Value	5 max.	5 max.	5 max.
Color	7 max.	7 max.	7 max.
Viscosity	Y ± 1 bubble	Z ± 1 bubble	Z ± 1 bubble
Weight per gallon	7.6 pounds	7.9 pounds	7.6 pounds
% solids	60 ± 1	60 ± 1	60 ± 1
Solvent	Mineral Spirits	Xylol	V.M.&P. Naphtha
Tack Free Dry	30 min.	15 min.	15 min.
Sward hardness—24 hour	29	26	28

For further technical information and samples, contact your nearest Spencer Kellogg representative or write directly to the technical Service Department, Buffalo 5, New York.

SPENCER KELLOGG AND SONS, INC.

BUFFALO 5, N. Y.

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- **Color**
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- **Miscibility with mineral spirits**
- **Benzene insoluble content**
- **Customer's specific tests**

Harshaw Driers are distributed nationwide. Your order will be shipped from the warehouse nearest to you.

TYPICAL HARSHAW DRIERS

Liquid Driers

- **Uversol (Naphthenate) Liquids**
- **Linoresinate Liquids**
- **Linoleate Liquids**
- **Octasols**
- **Pastes**
- **Pastalls**

Solid Driers

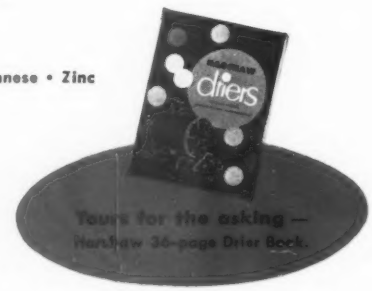
- **Uversol (Naphthenate) Solids**
- **Linoresinate Solids**
- **Linoleate Solids**
- **Soyate Solids**
- **Fused Resinates**

Powdered Driers

- **Precipitated Resinates**

Drying Salts

- **Cobalt • Lead • Manganese • Zinc**



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Analysis of Production Activities

By
Lawrence Shatkin

THOMAS Mann once said that order and simplification are the first steps toward the mastery of a subject—the actual enemy is the unknown. Clarence B. Randall further stated, "At each point in his life the business man has come to see that human nature manifesting itself in an infinite variety of forms is the element about which he knows least, and the one which causes him his deepest anxieties, and calls forth his greatest effort." To lessen the gap between the known and unknown will require an understanding of the creative process and the introduction of innovations in all spheres of activity. The roots for using management tools intelligently and attaining management objectives and goals is inherent in one that has a proper perspective of business problems. It is not only necessary that he have technical and human, skills but rather conceptual skills. By this I mean an ability to view and see the enterprise, its people and functions as a whole, and being able to recognize significant components in any situation.

Increasing productivity usually involves three main fields: organization and control of production, personnel policy, and plant and equipment. I shall deal with the first category.

Increasing Production

Production activities analysis should lead to increased productivity, which is of great importance to company survival, higher standard of living for the worker, and a base for social improvement. Any effort to reach this increased productivity could only succeed with good relations between management and their employees.

In going through plants one is apt to encounter two extreme conditions. In the first instance, men and machines are more or less idle. The second tendency is the apparent continuous hustle and bustle throughout the plant.

The first case would involve broad policy measures outside the jurisdiction of a production manager. It is the second supposition that is of interest to us. On the surface the latter situation may be the ideal state. However, further investigation would disclose that there existed less productivity and more chaos.

Obtaining Imformation

The introduction of a production activities analysis would reveal much interesting information. It is strongly urged that prior to this analysis, management inform their employees that this inquiry is being undertaken to reinforce the organization and help management reach their production objectives, which in turn will aid the company in reaching its goals, and ensure the worker of increased earnings. At the same time it affords the worker an opportunity to suggest how his job could be made easier, and what interruptions occur that take him away from his major duties.

Activity	Approximate time required per day
Head Shader	
1. Shading 2. Thinning	7½ hours
3. Obtaing color standards from the laboratory 4. Obtaining shading tickets from the laboratory 5. Consultation on color matching	½ hour
Assistant Shader	
1. Shading 2. Thinning (2-5 trips)	4 hours
3. Filling	1–3 hours
4. Replenishing shading bases (5-15 trips)	½–1 hour
5. Moving tanks	¼ hour
Helper	
1. Thinning batches (5-10 trips)	4–5 hours
2. Samples to laboratory (15-20 trips)	½–1 hour
3. Moving tanks	½ hour
4. Obtaining color standards from the laboratory (10 trips)	¼ hour
5. Replenishing shading bases (10-15 trips)	½–1 hour

Table I. Work activities of the shading department.

The opinions expressed in this feature are not necessarily those of any particular firm or organization.

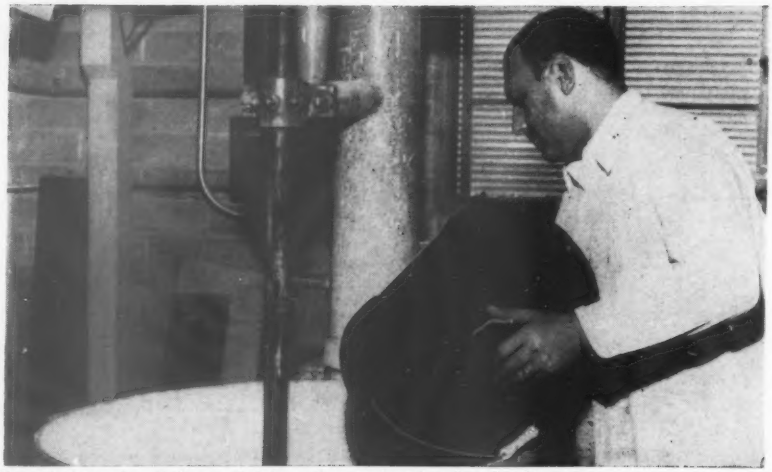
Shading Dept.

After explaining the purpose of the program to the group, individual explanations will take place as each worker is interviewed privately. A simple form should be used in gathering this information. The salient points would include the different activities the worker is engaged in, the approximate time required for these tasks, and any suggestions the employee may have to offer. It is recommended that one deal with specific work areas rather than cover the entire plant operations. For instance, investigation of your shading department could conceivably disclose the following facts in Table I.

An overall view of the shading department activities indicates that work simplification could be applied in order to decrease the number of trips these men have to make to different parts of the factory. Some changes would be simply to initiate, whereas, other changes would involve a reaffirmation of existing policy, or a change in policy, possible affecting other departments.

The men in this department might have suggested that new pipelines be installed or those in current use be changed to handle the materials used most frequently; the condition of the floor be improved so as to facilitate the movement of tanks; new shading procedures be introduced that will help cut down the number of trips made to the laboratory in order to obtain color standards or other records.

Further thinking in this area would show the need for the assistant shader to be trained as much as possible in the art of shading so as to eliminate a vulnerable position, and help increase production. It was projected that the number of batches shaded would have to increase one hundred per cent in order to meet future production requirements. This could only come about as the man became proficient in shading. In addition, color control procedures were to be oriented to simulate plant practices. These changes and modifications were the application of common sense. The innovation was the directed thinking in looking at the whole, rather than the parts.



Detailed study of the activities of a worker in the shading department must be made for a proper production analysis.

Labelling Dept.

A second area for analysis could be the labeling department. The ideal situation is to have good coordination between the labeler and filler. To secure proper analysis of any department involves the setting of objectives, asking the right questions, and implementing appropriate action toward reaching those goals. The crux of the problem is to eliminate any delays for labeled cans on the part of the filler. A collateral objective would be the securing of best balance between over-labeling and under-labeling.

An activity analysis of a labeling clerk could indicate the following:

1. Obtaining cartons	¼-½ hour
2. Obtaining labels	¼-½ hour
3. Adjusting machine	¼- 1 hour
4. Labeling cans	6 - 7 hours

Suggestions for improvement could describe the special storage of labels to minimize curling; the adoption of specifications to cover length, width and size of borders; the position of the labeler to ensure easy movement of body; an evaluation of records to determine where undue over-and-under labeling has taken place.

I am sure there are many other areas worthwhile investigating. The opportunity is there for improvement. These preliminary surveys will serve as a springboard for work simplification, consolidation of activities, elimination of certain operations, and initiation of new programs.

It must be remembered that the primary responsibility for any action to bolster productivity rest with management. Jobs can be made more interesting if the worker is given a sense of responsibility. The final product will be higher moral and increased production.

One objective of a production analysis is to obtain maximum coordination between the labelling and filling departments.

NATIONAL ANTIOXIDANT B®

keeps it flowing to the last brushful!

National Antioxidant B adds a really worthwhile selling feature to your paint at lower-than-ever cost!

Only 1 to 4 lbs. per 100 gallons is all it takes to prevent skinning over in the can . . . eliminate the need for straining . . . and customer dissatisfaction. There is no appreciable change in drying time, durability, odor or color retention.

National Antioxidant B is based on the essential ingredient that effectively retarded skinning in a wide range of formulations during the most exhaustive, unbiased tests ever reported*

Also available at new low cost is National ASA®, preferred for some formulations. For odorless paints National Antioxidant D® is recommended.

We will gladly send samples of all three for your evaluation.

*As reported in Official Digest.
Paint & Varnish Production Clubs, November 1956.

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- 3. Acicular structure affords good suspension
- 4. Mixes readily in all paint vehicles
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- 7. Uniformly low moisture content (less than .5% loss at 212°F.)
- 8. Bulking value 4.2 gallons per 100 lbs.
- 9. Packed in 50 lb. paper sacks for your convenience

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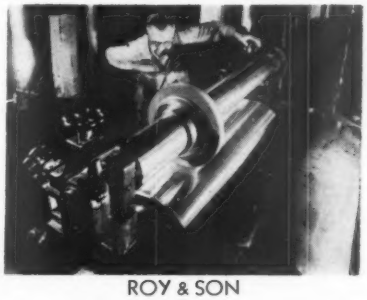
NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.

PORTABLE GRINDER

Eleminates Time Loss

"In place" portable grinder said to have eliminated the laborious and time consuming method used to retrue large rolls in roller mills.



ROY & SON

In the past, hand stones or other hand held abrasives were used to touch up nicks or gouges. Close tolerance grinding, however, was impossible unless the mill was dismantled and the rolls returned to the manufacturer. Now, portable grinder redresses to within .00045 on roundness and straightness right on the mill.

Periodic redressing, according to the manufacturer, also eliminates the need of removing several thousandths of stock to establish trueness.

B. S. Roy & Son, Dept. PVP, Worcester, Mass.

CASE IMPRINTER

On Corrugated Cases

Manually operated machine that imprints contents, brand and distributor or packer name and address on the ends of shipping containers.

New Carton Printer which can imprint copy legends up to 9" wide by 6" high on cartons is a compact, portable low price unit. In addition, it is claimed to have great flexibility in copy changes and carton size adjustments.

Carton Printer imprints the ends while the carton is made up and empty. Operator places the carton over a shelf, pulls a lever and makes an imprint. The machine is extremely easy to operate and requires no skill. This results, it is claimed, in a simple machine that produces high quality results.

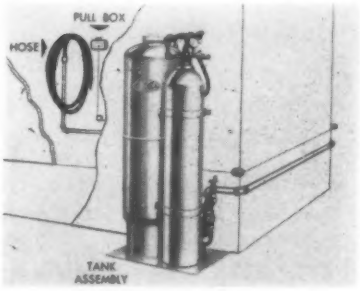
Rotary Imprinter, Inc., Dept. PVP, P. O. Box 31, Hillside 5, N. J.

CHEMICAL SYSTEMS

Full Remote Controls

Complete remote control from a distant hose site pull box is one of several features of the new stationary dry chemical hose line systems.

A single pull handle at the hose site simultaneously opens the valve, pressurizes the tank, and fills the system with fire-killing chemical powder.



FYR-FYTER

Other features include space-saving installation, improved nozzles and valves, and use of the new Formula H chemical powder with its proven heat-and-moisture resistance.

Three models are offered—150, 300, and 500 pound dry chemical capacity—in compact "package" designs requiring a minimum of floor space.

The Fyr-Fyter Company, Dept. PVP, 221 Crane Street, Dayton 3, Ohio.

WALKIE TRUCK

Operates in Minimum Space

High stacking loads in minimum aisle space claimed to be possible with compact, counterbalanced-type JackStacker "walkie" truck.

This truck, which has a 1000-pound capacity, has an overall length of just 63 ¾ inches with a 24-inch long load. The truck will maneuver and high stack goods in aisles as little as 5-feet, 10-inches wide with a 24-inch long load, extremely narrow for a counterbalanced-type truck.

Expecially recommended for situations where operating space is at a premium yet where the features of a counterbalanced-type truck are desirable, the truck is lubricated-for-life, eliminating all periodic lubrications.

It is operated from a control handle while walking along with it, thus its designation as a "walkie" truck. All controls, including brake, traction, lifting lower and tilting, are centrally located in the handle.

Lewis-Shepard Products, Inc., Dept. R8-21, Dept. PVP, 125 Walnut St., Watertown 72, Mass.

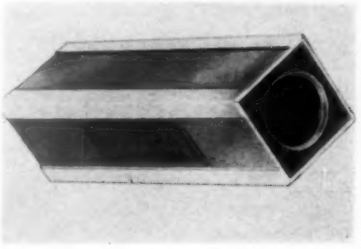
SCRAPER

Four Working Edges

New, unique scraper with four working edges now available.

Used in conjunction with the "Fineness of Grind" gage, it is claimed to have twice the life of the conventional 2-edge adco or knife-edge scrapers and is available in steel or hard chrome plate at only

PRECISION



a slight increase in price over the conventional scrapers.

Highly recommended for those who use these gages constantly.

Light in weight, it is easy to clean and handle and each edge is numbered. One edge can be used as a master to occasionally check the other three edges for wear.

Precision Gage & Tool Company, Dept. PVP, 320 E. Third Street, Dayton 2, Ohio.

GAS THERMATRON
Measures Gas Concentration

The concentration of one gas in a multi-component mixture can be measured selectively and continuously with a newly developed instrument, the M-S-A Gas Thermatron.

The instrument enables accurate gas analysis without chemical or physical changes of the gas mixture. It provides an improved means of utilizing the thermal conductivity principle of measurement with additional convection cells which take into account differences in convective heat losses from hot filaments through gases. Since convective heat loss varies with both molecular weight of gases and diameter of cells, convection cells of different diameter are provided in order to take advantage of the optimum thermal convection loss of each gas.

There are four cells with hot filaments in the M-S-A Gas Thermatron—two conduction cells of small diameter and two convection cells of selected large diameter. The filaments of these cells are the arms of a Wheatstone bridge circuit arranged with two parallel branches comprising one small filament cell and one large filament cell in series, and annulling resistors.

The instrument can be calibrated for any gas over either narrow (0-1%) or wide (0-100%) ranges of gas concentration. Accuracy is within 2 percent of full scale throughout the selected range.

Applications include process control, control of atmospheres and combustion, determination of gas purity, and many others. Typical examples are measurement of carbon dioxide in flue or exhaust gases, measurement of ethylene oxide in mixtures of carbon dioxide and air, and in mixtures of hydrogen, carbon dioxide, and air; measurement of hydrogen in furnace atmospheres, and measurement of hydrogen, carbon monoxide, and methane in mixtures of these three gases with air or nitrogen. Each instrument is designed for its specific application.

M-S-A Thermatrons draw 100 watts. Sample requirement is 100 to 1000 cc per minute. No pump is required. The instrument can be compensated for water vapor or, if desired, it can be measured. Speed of response is 60 seconds for 90 percent of full scale. Calibration is linear for most applications and is stable. Zero drift over a 30-day period is negligible.

Mine Safety Appliance Company Dept. PVP, Pittsburgh, Pa.

FLUORESCENT PIGMENTS
High Conspicuity

Eight high conspicuity bold fluorescent pigments for use in formulating all types of industrial safety, traffic and municipal, aircraft, marine and specialty paint lines.

These pigments: Pink, red-orange, green, yellow orange, red, lemon yellow, cerise red, and gold yellow can be toned by careful addition of non-fluorescent material to produce a wide variety of extremely brilliant, high visibility colors.

Supplied only in 100% pure form, these bold pigments are effective in brightening up non-fluorescent colors. Used in strictly fluorescent.

paint formulations, these colors claimed to last indefinitely indoors and will fade only gradually outdoors. The pigments are compatible with most vehicles and will take small amounts of transparent extenders.

Lawter Chemicals, Inc., Dept. PVP, 3550 Touhy Ave., Chicago 45, Ill.

BECK

PAINT MIXERS
Two Sizes

New line of Thor-O-Mix paint mixers in two sizes—Model A for gallons and smaller, Model B for quarts and smaller.

Claimed entirely new design and construction, these mixers employ a unique "pitch-tilt" throwing action that assures fast, thorough mixing of all kinds of paints or liquids. Even tightly caked pigments, metal pigmented paints, transparent color paints, house paints, etc. said to be quickly broken up and mixed in minimum time.

The machine consists of a frame which houses the 60 cycle 110 volt electric motor, as well as the gearing and eccentric which drives a rubber connecting rod to vibrate the cradle as it rocks on its two rubber bearing blocks. The oil bearings require no oiling. Rubber gripping pads, tightened by a hand-knob, hold either round or square cans in the cradle. Containers cannot fly loose or shake out.

Four rubber suction feet cushion the vibration and prevent creeping. A convenient on-off switch is provided. Machine is light weight for portability and compact for space saving on floor or counter.

Beck Equipment Company, Dept. PVP, 3350 West 137th Street, Cleveland 11, Ohio.

VOLUME PUMPS
Minimum Working Parts

New Milroyal line of controlled volume pumps for the chemical processing industries are now in production.

One design objective realized in the new Milroyal controlled volume pumps is the use of a minimum of working parts and bearing surfaces to translate high speed rotary motion to low speed reciprocating motion. Totally enclosed, this speed reducer is an integral part of the pumps and runs in an oil bath. This combined Polar-Crank drive unit and speed reducer permits manual or automatic adjustment of capacity from 0 to 100 percent. The capacity adjustment closely approximates a liner relationship and can be made while the pump is running.

Plunger of a Milroyal controlled volume pump always returns to the same forward position on each stroke regardless of stroke length to ensure maximum displacement efficiency.

Using standard speed motors, several of these controlled volume pumps can be coupled to a single motor yet each pump will have its individual capacity adjustment.

NEW MATERIALS — EQUIPMENT

The primary application for the Milroyal controlled volume pumps will be in the processing fields where chemicals must be metered accurately but dirty or corrosive atmospheres quickly damage less rugged equipment.

With liquid ends constructed of alloy steels for corrosion resistance, these pumps have maximum capacities to 29 gallons per hour and will meter against pressures to 1900 psi.

Milton Roy Co., Dept. PVP, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

MELTING APPARATUS
Rapid Heating

New melting point apparatus said to be eminently successful in carrying out accurate, reproducible determinations in a minimum of time.

Heating is rapid to within five or ten degrees of the melting point. Further temperature increases can then be reduced to one or two degrees per minute.

Appartus saves considerable time between tests because the small mass of heating fluid used plus its low specific gravity allows rapid cooling. Without compressed air, cooling takes ten minutes from 300 to 100°C, and eight minutes more to 60°C. With compressed air, the corresponding times are four minutes and one and one-half minutes.

Arthur S. LaPine & Co., Dept. PVP, 6001 South Knox Ave., Chicago 29, Ill.

LAPINE

TEMPERATURE CONTROLLER
For Pneumatic Operators

A pneumatic recording temperature control, designed primarily for industrial process uses.

The control, a simple mercury-actuated mechanism utilizes no electricity and is particularly well adapted for use by process industries where a precise, explosion-proof, throttling-type control is required. The control utilizes a 15-pound air line to actuate an air-operated steam valve or other air operated device.

Available in any of 10 optional temperature ranges within the extremes of -30 to 1100 degrees F. It features a 10-inch circular chart and chart drives of 24 and 48 hour and 7-day in either spring drives for explosion proof applications or electric drives, if desired.

Among its features are readily adjustable throttling range, 3 to 20% and a fail-safe provision, which shuts off the valve or device if there is any failure of air supply to the instrument. This eliminates any possibility of damage by the uncontrolled heating medium.

The instrument is actuated by a mercury-filled thermal element. The control varies the air pressure between the control and the air operated valve in direct proportion to temperature change. A rise in temperature at the point being con-

trolled is sensed by the control which modulates the air pressure to the air operated valve. Depending heat has risen, the valve will restrict the supply of heating medium.

Accessories recommended for use with the control including an air filter, regulator, gages and an air operated diaphragm-valve are available as an optional package.

Partlow Corp., Dept. PVP, 509 Campion Road, New Hartford, N. Y.

CONTAINER STAPLER
Rapid Performance

Giant Container Stapler—Model G—closes 1100 lb. test triple wall or double wall boxes for as little as one cent.

Model G (Giant) delivers over half a ton of pressure with each stroke-that's stapling to stay. This power tool "sets-up" the bottoms of empty triple wall or double wall boxes just as cheaply as it closes the tops.

It drives staples with big, long legs. Only a few Giant Economy size staples are required to "set-up" or close the top of any average size triple wall or double wall box. Staple leg lengths: 7/8"—1"—1-1/8"—1-1/4"—1-3/8".

Automatic double acting pneumatic piston said to guarantee rapid performance—rugged endurance.

Furnished complete with lubricator and air filter. Automatic water trap eliminates production down-time for trap drainage.

Container Stapling Corp., Dept. PVP, 308 N. Park Ave., Herrin, Ill.

LACQUER SOLVENT
Miscible With Water

Poly-Solv EE acetate, a solvent for lacquers, now available.

Poly-Solvs are clear, almost odorless liquids, miscible with water and most organic solvents. Containing both an ether and an alcohol group, they are strong solvents for a variety of substances.

Organic Chemicals Department, Olin Mathieson, Dept. PVP, 745 Fifth Ave., New York, N. Y.

NEW MATERIALS — EQUIPMENT

ALKYD RESIN
Formulating Baking Enamels

Development of a new alkyd resin, designated as Glyptal ZA-114 solution, for use in formulating baking enamels requiring color and gloss retention at temperatures in the 400F range.

Resin bridges the gap between the hear resistance of conventional saturated oil-modified alkyds and silicones in imparting superiority of overbake and gloss retention to alkyd-melamine baking enamels. Such formulations also have excellent hardness, flexibility and adhesion.

Combinations of ZA-114 with urea-formaldehyde or melamine-formaldehyde resins said to result in approximately twice the baked hardness of conventional saturated oil-modified, alkyd-amine resin blends, without any sacrifice in flexibility and adhesion.

Properties of extreme baked hardness, combined with good adhesion, flexibility and excellent overbake color and gloss retention, are claimed.

Chemical Materials Department, General Electric Co., Dept. PVP, Anaheim, Cal.

DEFOAMING COMPOUND
For PVAc Formulations

A 100% active liquid defoaming compound for vinyl acetate formulations.

Foamtrol #103 said to be an efficient and inexpensive means of eliminating foam during the manufacturing and application of vinyl acetate based paints and coatings. In most applications a concentration of 0.1% by weight is sufficient to handle the average foam problem.

Foamtrol #103 is also claimed to eliminate foam build up in emulsion and suspension polymerization of polyvinyl acetate, polyvinyl chloride, acrylics and many other reactions. Literature and samples available on request.

Arlen Chemical Corp., Dept. PVP, 338 Wilson Ave., Newark 5, N. J.

NEW DU PONT PVA EMULSIONS, resulting from extensive research and development, are poured into beakers preparatory to extensive product testing at Du Pont's new Sales Technical Laboratory near Wilmington, Del. Results of these tests are shown on the following pages. These new emulsions are "ELVACET" 1423 polyvinyl acetate copolymer and "ELVACET" 1440 polyvinyl acetate homopolymer.

Du Pont ELVACET®

polyvinyl acetate emulsion

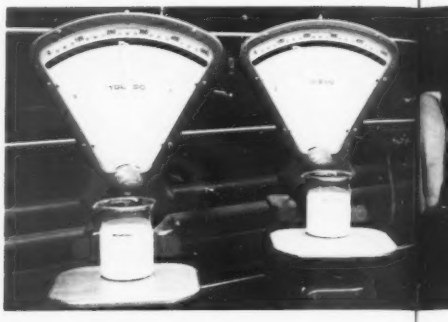
is your best buy in PVA emulsions

TURN THE PAGE FOR PROOF

Only DuPont ELVACET® gives you all

polyvinyl acetate emulsion

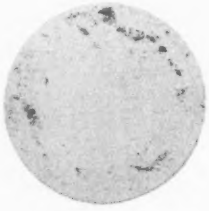
. . . plus an exclusive combination of



RESISTANCE TO FOAMING

The Test: 800 grams of "ELVACET" 1423 and of a leading competitive emulsion were agitated simultaneously on a paint shaker for 10 minutes (left photo). Beakers of identical weight were placed on lab scales. Result: When equal volumes of the two emulsions were poured into the beakers, foam-resistant "ELVACET" 1423 (left beaker) weighed 64% more, because competitive emulsion trapped high percentage of air.

Significance: "ELVACET" 1423 and its companion product "ELVACET" 1440 reduce foaming trouble during manufacture . . . eliminate the mixing, packaging and application problems encountered with aerated batches of paint. It's one of the "extras" you get with "ELVACET"!

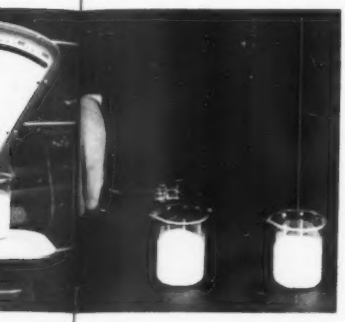


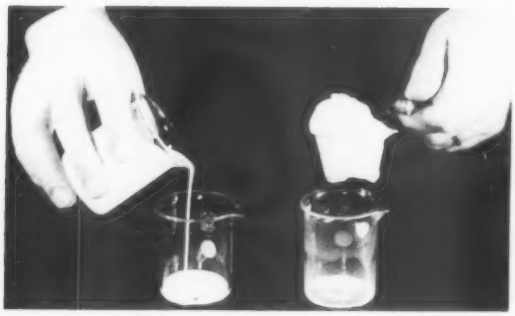
MECHANICAL STABILITY

The Test: 200 grams of "ELVACET" 1423 and of a leading competitive emulsion were agitated vigorously for 2 min. in a household blender. Each emulsion was then passed through a 60-mesh screen. Both screens were allowed to dry. Result: "ELVACET" 1423 (left) passed through leaving practically no agglomerated material on screen. Competitive emulsion left relatively high amount of residue on the screen (right).

Significance: "ELVACET" 1423 and "ELVACET" 1440 are insurance against gritty batches of paint. Both emulsions withstand vigorous pumping and mixing without breaking down . . . can save you costly reject batches. It's another of the "extras" you get with "ELVACET"!

you all the basic PVA emulsion properties
tion of these high-quality extras!





BORAX TOLERANCE

The Test: 60 ml. of "ELVACET" 1423 and of a leading competitive emulsion were each poured into 100 ml. beakers (left photo). 10 ml. of a saturated borax solution was then added to each beaker and stirred. Result: "ELVACET" 1423 (left beaker) remained completely fluid, while other emulsion agglomerated into a rubbery mass.

Significance: Your paint can be used safely over taped joints in drywall construction when it's based on "ELVACET" 1423 or "ELVACET" 1440. No danger of balling. It's still another of the "extras" you get with "ELVACET"!

CRYSTAL-CLEAR FILMS

No tendency to yellow on heating or aging. Films cast from "ELVACET" 1423 and "ELVACET" 1440 stay clear . . . your assurance of superior whiteness retention. It's one more important "extra" you get only with Du Pont "ELVACET" PVA emulsions.

"Elvacet" costs no more than ordinary PVA emulsions

In addition to the high-quality "extras" shown above, Du Pont "ELVACET" polyvinyl acetate emulsions give you all the *basic* properties of a superior PVA emulsion, such as small particle size, good water resistance and good pigment binding.

Other quality emulsions can provide you with these basic properties, and may have one or two of the "extras". *Only* "ELVACET" offers paint manufacturers PVA emulsions that have *all* the basic properties, plus *all* of these important "extras"! Turn the page for still more benefits you get with Du Pont "ELVACET" emulsions.

More reasons why "Elvacet" is your best buy in PVA emulsions

TESTED FORMULATIONS . . . over 7000 panels based on "ELVACET" formulations have been exposed in the past 10 years at Du Pont's Wilmington, Del., Paint Test Farm shown above. You're invited to visit the farm and learn about these exposure histories. If paints make good here, they'll make good for you!

LATEST RESEARCH INFORMATION from Du Pont's new 2 million dollar Sales Technical Laboratory. Here specialists constantly work to improve PVA paint quality, lower formulation costs. This enables your Du Pont Technical Representative to keep you abreast of all new PVA developments, new paint formulations and other useful data.

FOR FURTHER INFORMATION, call your Du Pont Technical Representative at the nearest District Office listed below. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

DISTRICT AND SALES OFFICES: BALTIMORE • BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • KANSAS CITY* • LOS ANGELES • NEW YORK • PHILADELPHIA • SAN FRANCISCO • EXPORT DIVISION, WILMINGTON 98, DELAWARE

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DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

ELVACET®

1423 polyvinyl acetate copolymer emulsion
1440 polyvinyl acetate homopolymer emulsion

TECHNICAL Bulletins

INFLUENCE OF MICA

Technical bulletin No. 36 of the Wet Ground Mica Association, Inc., Dept. PVP, 420 Lexington Ave., New York 17, N. Y. issued in October 1958 continues the series of *Studies on the Influence of Mica on the Water Vapor Permeability of Paint Films.* In this Bulletin, alkyd paints based on titanium dioxide are studied with one single extender. The results show that wet ground mica as the only extender provides greater sealing characteristics than the paint with no extender at all and the paint with another extender.

Technical bulletin No. 34, which inaugurated this series, presented studies on paints with low pigment volume concentration and technical bulletin No. 35 presented studies of paints with regular pigment volume concentration and studies on the water vapor resistance of latex paint films. This series clearly demonstrated that wet ground mica with its particular platy shape helps to improve the vapor sealing characteristics of both alkyd paints and latex paints.

All technical bulletins are based on a continuing research program at New York University under the supervision of Dr. Max Kronstein.

INSTRUMENTS & APPARATUS

The availability of a new, 175-page catalog illustrating and describing more than 450 different pieces of instruments and apparatus has been announced by Labline, Inc., Dept. PVP, 3070-82 W. Grand Ave., Chicago 22, Ill.

The catalog covers a wide range of apparatus and equipment useful in both the laboratory and the plant.

The 1959 catalog has embossed leatherette covers with multi-ring binders, and illustrates and describes such items as constant temperature baths; drying ovens; environmental units for humidity, altitude and low temperatures; an extensive line of petroleum testing equipment; sectional laboratory furniture; bench and floor model centrifuges; Alumaloy clamps; walk-in ovens; reach-in ovens to 1000° F., incubators; incubating rooms; refrigerated baths; constant temperature cabinets; serological baths, meters; humidity indicators; and other useful apparatus for the laboratory and plant.

PALLET HANDLING

A 24-page handbook, "Pallet Handling in Narrow Aisles," has been made available by the Raymond Corp., Dept. PVP, 345-170 Madison St., Greene, N. Y.

The handbook identifies all the popular styles of pallets, gives the labor saving advantages of unit load handling, and lists the space saving benefits of narrow aisles in warehouses.

The handbook also describes the principle types of trucks available for narrow aisle operations and shows on-the-job pictures of the equipment in use.

MICRO-KLEAN

Depth-type fiber cartridge filters for full flow filtration of all types of fluids are presented in the new Micro-Klean Catalog #53-101, The Cuno Engineering Corp., Dept. 53. PVP, South Vine Street, Meriden, Connecticut.

Complete information is given on the full advantages of Cuno's exclusive "graded density" cartridge construction. Selection of the proper filter and filter cartridge to meet any application requirement is facilitated by the Micro-Klean

Selector Chart, cartridge life curve, flow rate table, and other product performance information contained in the catalog.

Essential dimension, weight and installation data complete with line drawings and pictures is provided for the smallest to the largest filter model series.

INDUSTRIAL EXPANSION

"National Distillers and Chemical Corporation Expands in the Chemical Industry," is the title of a new brochure published by U. S. Industrial Chemicals Co., Division of National Distillers & Chemical Co. & Chemical Corp., Dept. PVP, 99 Park Ave., New York, N.Y.

Designed for stockholders, employees, prospective employees, and its U. S. Industrial Chemical Co. Division customers, the 40 page booklet is designed to explain to people how the company invested in chemicals and grew in less than a decade to a leadership position in the chemical industry.

Sections labeled "How We've Grown", "How We're Organized", "What We Make", "Where We Produce", answer the question of where the company is now, along with how it got there.

Highlight of the book is a "Plant-Tour" section, where each of the company's major plant and research locations is shown in detail in a series of colored photographs.

PAINT AUDIO-FILMSTRIP

A 15-minute audio-filmstrip, "Researching Tomorrow's Paints," is available for showing by the Dewey and Almy Chemical Division, W. R. Grace & Co.

The filmstrip describes Dewey and Almy's research program for continual improvement of latex paint emulsions and reports latest results of the division's exterior exposure test house project.

Showings can be arranged through Dewey and Almy offices in Cambridge, Mass.; Clifton, N. J.; Chicago, Ill.; and San Leandro, Calif.

PARAFFIN WAXES

A 16-page technical bulletin describing the company's microcrystalline and fully refined paraffin waxes has been made available from the Sun Oil Co., Industrial Products Department, Dept. PVP, 1608 Walnut Street, Philadelphia 3, Pa.

Included is information on properties, emulsions, testing methods, and packaging. Nineteen charts provide data on penetration, viscosity, density, and solubility of the waxes at various temperatures.

LEASING MATERIALS

Methods of leasing materials handling equipment are described in a new 4-page circular available from Lewis-Shepard Products, Inc., Dept. R8-26, PVP, 125 Walnut St., Watertown 72, Mass.

Three plans to acquire equipment without tieing up working capital are included in the circular. The plans are Lease Option, Straight or True Leases and "Power Package" Leases.

Under the Lease Option Plan, the lessee takes title to the equipment at the completion of payments. With Straight or True Leases title to the equipment remains with the essor. "Power Package" Lease plans allow the user to lease the battery and charger for his electrically-powered fork lift trucks.

ROTARY PUMPS

A new hydraulic data bulletin has been released by the engineering department of the Blackmer Pump Co., Dept. PVP, Grand Rapids, Mich. Its purpose is to assist operators, engineers, maintenance supervisors, distributors and other technical men in planning installations of rotary pumping equipment.

Following an outline of the factors involved in pump selection

along with definitions of commonly used hydraulic terms, the 28-page bulletin describes two basic methods for computing the suction and discharge conditions of a given installation.

The first is illustrated with an actual example and employs direct-reading friction charts for quick, preliminary computations. The second method makes use of a standard intake and discharge analysis form which is reproduced step for step in the bulletin, and used in conjunction with six pages of pipe friction curves as published by the Hydraulic Institute for 12 sizes of steel pipe. A separate chart is included to permit calculation of friction loss in various types of valves and pipe fittings.

The balance of the bulletin is given to a variety of data to assist in pump selection.

FLUORESCENT PIGMENTS

Lawter Chemicals, Inc., Dept. PVP, 3550 Touhy Ave., Chicago 45, Ill., has announced the availability of a comprehensive brochure on bold fluorescent pigments.

Detailed descriptions of physical properties, solubility, weatherability, chemical resistance, formulations, and applications are given.

Also included is a brief background on the phenomenon of fluorescence.

ALUMINUM SOAP

A service bulletin describing Witco Alumagel is now being offered by Witco Chemical Co., Inc., Dept. PVP, 122 East 42nd St., New York 17, N. Y. It is a new aluminum soap developed to gel solvents without the use of heat.

The bulletin contains technical data on the formation of stable gels from typical non-polar solvents and mixtures of polar and non-polar solvents. Some uses of the product as in paint removers, flat paints, plastisols, rubber cements and fire starters are suggested.

ALKYD FORMULATOR

An easy to operate alkyd formulator based on data in the article, *The Molecular Approach To Alkyd Structure* by Dr. W. M. Kraft has been made available by the Heyden Newport Chemical Corp., Dept. PVP, 342 Madison Ave., New York 17, N. Y.

Can be used to determine if an alkyd formulation will result in a usable or gelled resin and also to formulate usable alkyd resins.

PENTAERYTHRITOL

A detailed description of PE 681 is now available in a newly published four-page technical bulletin made available by Reichhold Chemicals, Inc., Dept. PVP, 525 North Broadway, White Plains, N. Y.

The bulletin has sections devoted to the physical properties and specifications of PE 681 as well as a listing of typical reactions.

Correction

It has been brought to our attention that on page 33 of the July, 1958 issue, mention was made that "Freon" 11 was a toxic solvent. To clarify this statement, we quote from the "Freon" Solvent Bulletin published by the E. I. du Pont de Nemours & Co., Inc., "Freon" Products Division Wilmington, Del., page three under the heading, "Safety," paragraph four, the following: "Maximum allowable concentration values for chronic exposure have not been definitely established but the indicated values for "Freon"—MF ("Freon" 11) are 1,000 ppm."

New Developments

Water Soluble Resins Developed by ADM

Arolon 1000, a water soluble resin that eliminates the hazard of flammable solvents yet retaining the properties of high quality organic solvent thinned alkyd-melamine systems, was introduced by Archer-Daniels-Midland Company at the National Paint Industries Show in Cleveland.

W. G. Andrews, ADM vice president and manager of the resin and plastics division, said Arolon 1000 is so fire-safe its spray will extinguish the flame of a blow torch.

Termed by Andrews a new concept in the industrial finishing field, the ADM resin has many of the advantages of both non-drying and drying alkyds used in baking finishes.

On baking it converts to a hard, tough, mar-resistant film which rivals melamine modified coconut alkyds for color and gloss retention and chemical resistance. Toughness, adhesion and resistance to mar, juices, greases, salt spray and water equal those of melamine modified short soya alkyds.

Andrews said Arolon 1000, developed in ADM's research center, is the first versatile top coat resin of the water soluble type introduced generally to the industrial finishing industry.

In addition to its fire safety, Arolon 1000 offers other advantages to paint manufacturers and industrial finishers, including simple formulation and easy cleanup of manufacturing and appliances, office equipment, metal furniture, interior appointments on automobiles, toys and hundreds of other metal products employing sprayed-on baking enamels.

The excellent gloss and color retention of Arolon 1000 make the resin ideal for high quality finishes as well as for a broad range of colored enamels.

Specifications for Arolon 1000 are:

Viscosity	V-Z
Per Cent Solids	45 ± 1
Color—Gardner '53	3 Max
pH	7.5-9.0
Weight per Gallon (Solution)	9.0-9.15 lbs
Weight per Gallon (Solids)	10.9 lbs
Reduced Viscosity C-E	25% ±1

In addition to the fine qualities of high grade conventional resins, Arolon 1000 is an efficient grinding vehicle and requires no change in customary pigment dispersing techniques.

Enamels produced with the new ADM resin have long storage stability superior to conventional melamine modified industrial enamels. Formulas are simple since thickeners, stabilzers, bactericides and wetting agents are not required.

Arolon 1000 is a low viscosity, light colored solution. Since it is a solution rather than an emulsion, there is no freeze-thaw problem. Because it is pre-stabilized, corrosion problems are minimized.

The following table summarizes the hardness data obtained after baking Arolon 1000 at temperatures from 200°F to 300°F for various periods. The information is based on 1.5 mil. wet film drawdowns of clear resin at 45% solids on glass baked without driers or catalysts.

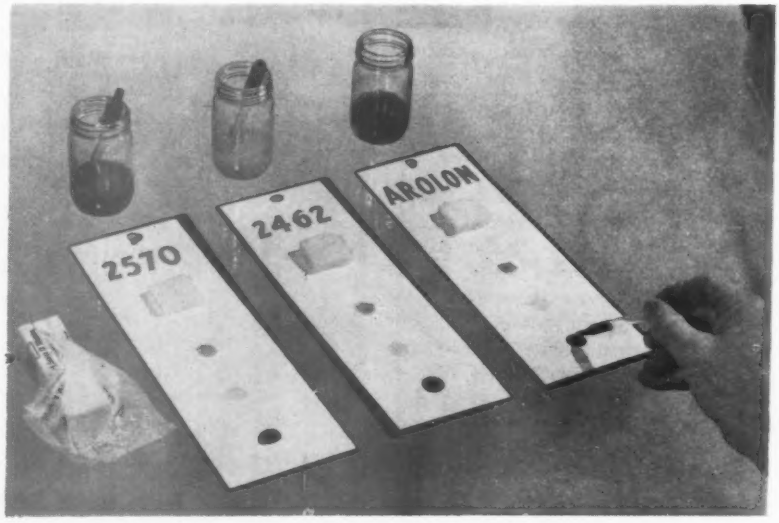
Baking Schedule	Sward Hardness of Arolon 1000 Sward Hardness
20 Min. at 200°F	16
30 Min. at 200°F	20
40 Min. at 200°F	32
20 Min. at 250°F	28
30 Min. at 250°F	34
40 Min. at 250°F	34
20 Min. at 300°F	34
30 Min. at 300°F	36
40 Min. at 300°F	36

Standard chemical resistance tests for appliances show the following film performance for Arolon 1000:

Staining of Baked Film (30 min. at 250°F)	
Oleic Acid	Moderate
Cottonseed Oil	Moderate
Grape Juice	None
Lemon Juice	Very Slight
Butter	None

Effect of Detergent (Baked 30 Min. at 300°F)	
24 hours	None
48 hours	None
72 hours	Very Slight Blistering
96 hours	Slight Blistering

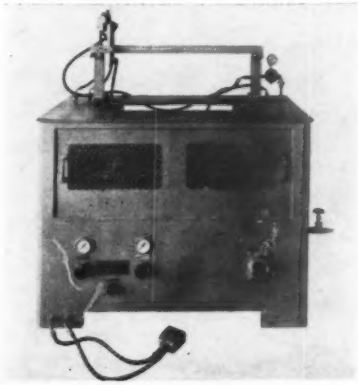
After six months on south 45° Florida exposure, Arolon 1000 enamels show no checking or cracking. The initial gloss retention is comparable with standard baking alkyds. After three months of accelerated Florida exposures, however, the Arolon 1000 finish develops chalking slightly faster than standard baking alkyds. Eight months of south 45° exposure in Minnesota show only very slight loss of gloss on white enamels.



Test panels of finishes made with Arolon 1000 (right) and conventional solvent-thinned resins show ADM's new water soluble resin equals the others in resistance to butter, fruit acids and cooking greases.

Automatic Spray Painting Machine

Absolutely even deposition of paint material to the same thickness over the entire area of the piece part is assured by a new automatic spray painting machine just developed by the Conforming Matrix Corporation.



New spray painting machine.

The positive mechanical reciprocating drive permits smooth gun travel with no pauses even when the two traversing guns reverse their direction. Thus it is unnecessary to overshoot the part with resultant excess paint deposit on the part and mask. Gun travel can be right up to the edge of the part and then reversed. The guns paint in both directions, automatically shutting off at the end of each stroke. These features make this new machine especially desirable in translucent applications. The machine is also ideal for companies with limited air supply, air being required only for the triggering of the spray guns.

The machine sprays areas up to 8″ wide and 22″ long, the length of the paint coverage depending upon the setting of the control valves, between 12″ and 22″. The speed of gun travel is adjustable from 35 to 90 feet per minute.

Electric motor and chain drive operation is employed, the motor being ¼ HP, 110 volt, single phase, 60 cycle, wired in accordance with NEMA Code 7 for explosion proof purposes. The design complies with all JIC Standards and Factory Mutual.

All dials and regulators are on the face of the machine, and all working parts are totally enclosed. The mechanism is automatically oiled with pneumatic oil lubricator.

The machine is supplied complete with two automatic spray guns, and a 12″ diameter round exhaust duct collar. It is 36″ high, 47″ long and 30½″ deep. There are a number of optional feautres, including explosion-proof electric counter for pre-selection of number of painting strokes; explosion-proof electric timer which controls duration of loading time and maintains steady operation; air clamping hold-downs to seat flimsy or warped parts firmly into masks; and tilting guns on larger models where jobs require difficult paint angles, or can be built to suit a customer's particular requirements.

Improved NoVo Systems Lowers Processing Costs

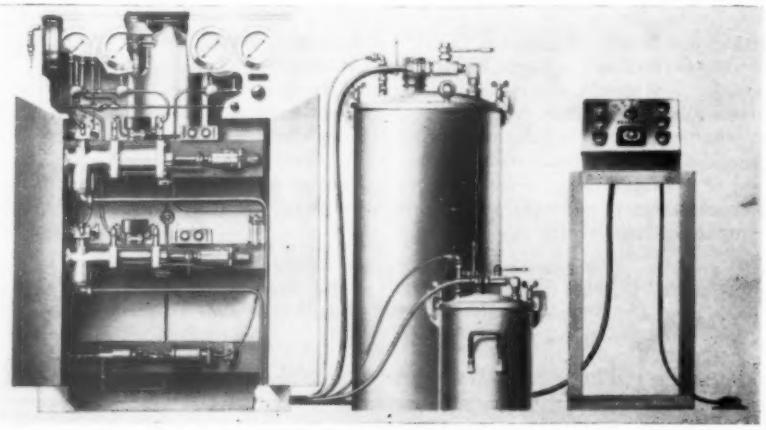
Lowered production costs and improved product quality are two advantages of new improved, automatic equipment for proportional metering, mixing and metered dispensing of multi-component reactive liquid resins now being introduced by Mitchell Specialty Division of Industrial Enterprises, Inc., John C. Pickly, president of Mitchell Specialty Division, announced.

Mitchell Specialty has acquired the exclusive patent rights and has improved designs for NoVo Metering and Mixing Systems which were formerly supplied by Applied Engineering Associates of New York. Marvin Schneider, designer and inventor of the patented Systems, has joined Mitchell Specialty as general manager of the Process equipment department. He will coordinate technical liaison with customers and handle application engineering. Jack Dunnous is in charge of design and development engineering. Mr. Dunnous has wide experience in fluid mechanics, electro-hydraulic and electro- mechanical systems.

NoVo Systems have helped to expand and facilitate the use of multi-component reactive liquid resins in many industries by materially reducing the high production costs and quality variations often encountered in processing epoxies, polyurethanes, polyesters, polyamides and polysulphides. They have, for instance, been used for thermal, acoustical and electrical applications in the aviation, automotive and marine fields; for space and void filling, pressure, corrosion, and shock-resistant installations in the electronics industry; for bonding, casting and molding operations, and for applying protective coatings in industry generally.

In addition to substantially cutting production costs by maintaining uniform high quality of finished product, NoVo equipment increases speed of processing, application and curing. Consequently, less investment in floor space, in molds and in curing equipment is required.

Further savings are realized in handling short pot-life resins—as short as 8 to 10 seconds—without freeze-up or clean-up, and in using low cost, high molecular weight or hot-melt resins with improved physical properties. Hand labor for transfer, weighing, mixing, dispensing and application; waste and spillage in transfer; and costly "rejects" due to inaccurate batch make-up and dispersing are also eliminated.



NoVo system developed by Industrial Enterprises, Inc.

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Pearlescent Type Coating Composition

U. S. Patent 2,851,370. Robert E. Blank, Mayfield Heights, Ohio, assignor to the Sherwin-Williams Co., Cleveland, Ohio, a corporation of Ohio.

A pearlescent coating composition comprising a water-insoluble film-forming lacquer and mica having a particle size ranging from 1 to 100 microns, in which composition the pearlescent pigment to binder ratio by weight is from about 3:1 to about 7:1.

Protective Coatings For Metals

U. S. Patent 2,854,368. Louis Lionel Shreir, London, England.

A solution for forming protective coating on metals, comprising phosphoric acid of 1 to 8 moles concentration, and at least one tannin material in a proportion of between 1 and 35% by weight based on said solution.

Oxidation of Castor Oil

U. S. Patent 2,851,471. Joseph Nichols, Princeton, N. J., assignor to Ethicon, Inc., a corporation of New Jersey.

A process for the oxidation of castor oil comprising heating castor oil in solution in an inert organic solvent and a ketone, selected from the group which consists of low molecular weight aliphatic and acyclic ketones, with a compound of the class of low molecular weight aluminum secondary and tertiary alkoxides, for a period of time of not longer than about 15 minutes and at a temperature not substantially above 115° C. to provide oxidized castor oil in which the predominant components are glycerides of 12-keto-oleic acid.

Method For Testing Coatings

U. S. Patent 2,851,338. Iral B. Johns, Santa Fe, N. Mex., and Amos S. Newton, Ames, Iowa, assignors to the U. S. A. as represented by the United States Atomic Energy Commission.

A method of detecting defects in the coating of a coated article comprising an easily hydridable metal base and a difficultly hydridable jacket on the base which comprises exposing said coated article to an hydriding agent at a temperature sufficiently high to form the hydride of said base metal in any pores which may be present in the coating whereby to effect enlargement of such pores.

Improving Colored Lacquers

U. S. Patent 2,853,397. Heinrich Seibert, Wilhelm Bunge, and Otto Bayer, Leverkusen, Germany, assignors to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany, a corporation of Germany.

The process of manufacturing improved organic dyestuff colored lacquers which comprises incorporating N-substituted urethanes of the group consisting of polyurethanes containing at least 2 urethane groups per molecule and urethanes having at least 1 urethane group bound to a cyclic radical.

Coating Compositions For Metal Surfaces

U.S. Patent 2,855,376. James A. Shotton and Lee O. Edmonds, Bartlesville, Okla., assignors to Phillips Petroleum Co., a corporation of Delaware.

A composition suitable for coating metal surfaces comprising, (1) a liquid polymer, in which a major amount of the polymer is formed by 1,2 addition, selected from the group consisting of homopolymers of conjugated dienes containing 4 to 6 carbon atoms and copolymers prepared by polymerizing, based on 100 parts by weight of monomers, at least 70 parts of a conjugated diene containing 4 to 6 carbon atoms and up to 30 parts of copolymerizable monomers containing a $CH_2=C<$ group; and (2) polymeric material selected from the group consisting of rubbery polymers in which the major amount of the polymer is formed by 1,4 addition selected from the group consisting of homopolymers

of conjugated dienes containing 4 to 6 carbon atoms and copolymers prepared by polymerizing, based on 100 parts by weight of monomers, at least 70 parts of a conjugated diene containing 4 to 6 carbon atoms and up to 30 parts of copolymerizable monomers containing a $CH_2=C<$ group and said rubbery polymers wherein the unsaturation has been reduced to a value of 10 to 60 percent of the original unsaturation by hydrogenation; the amount of the second polymeric material being 2 to 20 percent by weight based upon the total polymeric material employed.

Emulsified Composition For Latex Paints

U.S. Patent 2,856,300. John F. McKay, Cranford, N.J., assignor to Esso Research and Engineering Co., a corporation of Delaware.

An emulsifiable composition suitable for latex paints which comprises the alkali metal salt of an oxidized copolymer of butadiene-1,3 and styrene, said copolymer having a molecular weight of about 2,000 to 5,000 and containing from about 8 to 20 wt. percent of combined oxygen.

Polyvinyl Resin Compositions

U.S. Patent 2,857,349. Frank P. Greenspan and Ralph J. Gall, Buffalo, N.Y., assignors, by mesne assignments, to Food Machinery and Chemical Corp., San Jose, Calif., a corporation of Delaware.

A plasticized polyvinyl resin composition comprising a polyvinyl resin from the group consisting of polyvinyl butyral, the homopolymers of vinyl chloride and vinyl acetate, and the copolymers of vinyl chloride with vinylidene chloride, and vinyl chloride with vinyl acetate, and an epoxidized ester, said epoxidized ester having been prepared by epoxidation of an ester formed by esterifying (*a*) a mixture of fatty acids having at least 18 carbon atoms and containing at least about as great a percentage of monoethylenically unsaturated fatty acids as is combined in safflower oil and not more monoethylenically unsaturated fatty acids than is contained in tall oil and at least about as great a percentage of polyethylenically unsaturated fatty acids as is combined in corn oil and not more polyethylenically unsaturated fatty acids than is combined in safflower oil (*b*) an alcohol from the group consisting of the lower aliphatic monohydric alcohols and the aliphatic polyhydric alcohols, and said epoxidized ester having been epoxidized to the extent required to epoxidize substantially all of the double bonds present in each ethylenically monounsaturated and one only of the double bonds present in each ethylenically polyunsaturated fatty acid residue in said ester, by reaction of said ester under epoxidizing conditions with a peracid employed in an amount of about 1 to 1.3 moles of peracid for each double bond in each mole of esterified ethylenically monounsaturated acid plus 1 to 1.3 moles of peracid for one double bond only of each mole of esterified ethylenically polyunsaturated acid.

Vinyl Toluene—Alkyd Coating

U.S. Patent 2,857,347. John W. de Groot, Jr., and Burt F. Hofferth, Manheim Township, Lancaster County, Pa., assignors to Armstrong Cork Co., Lancaster, Pa., a corporation of Pennsylvania.

A paint composition comprising filler, pigment, solvent, and a vehicle comprising about 90%-70% by weight vinyl toluene-siccative oil copolymer, and about 10%-30% by weight nondrying alkyd resin comprising the reaction product of about 40-90% by weight of a nondrying glyceride oil with a polyhydric alcohol and an aromatic dibasic acid, wherein the hydroxyl equivalents of said alcohol are in 10-30% excess of the carboxyl equivalents of said acid.

Alkyd—Nitrocellulose Coating

U.S. Patent 2,857,344. Aloysius N. Walus, Flint, Mich., assignor to E. I. du Pont de Nemours and Co., Wilmington, Del., a corporation of Delaware.

A liquid coating composition comprising pigment, volatile organic solvent, and organic film-forming material consisting essentially of (1) a butyl methacrylate-alkyd resin copolymer containing, in each 100 parts by weight thereof, (*a*) 20-60 parts by weight of butyl methacrylate and (*b*) 80-40 parts by weight of a phthalic glyceride alkyd resin having an acid number less than 10 and containing chemically combined therein

40%-55% of a member of the class consisting of coconut oil and coconut oil fatty acids, 1%-8% of maleic anhydride, and unesterified hydroxyl groups in an amount equivalent to 0.4%-10.2% of glycerine, the percentages being by weight based on said alkyd resin, and (2) lacquer-grade nitrocellulose, the weight ratio of said copolymer to said nitrocellulose being between 1:1 and 3:1.

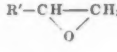
Water-Displacing Agent

U.S. Patent 2,856,299. Roy A. Westlund, Jr., Roselle, N.J., assignor to Esso Research and Engineering Co., a corporation of Delaware.

A liquid rust preventive composition comprising about 75 to 99 parts of an oleaginous base, about 0.5 to 15 parts of a partial ester of a fatty acid having about 12 to 22 carbon atoms per molecule and an aliphatic polyhydric alcohol having about 3 to 12 carbon atoms per molecule, and about .1 to 10% of a water displacing agent, said water displacing agent being the condensation product of (1) the fatty acid-polyamine reaction product of substantially equimolar portions of a fatty acid containing about 10 to 22 carbon atoms and a polyamine having the formula:

$$NH_2(C_nH_{2n}—NH)_xC_nH_{2n}NH_2$$

wherein n is an integer of about 1 to 4 and x is an integer of about 0 to 3, and (2) about 1 to 10 moles of an alkylene oxide having the formula:



wherein R′ is a member selected from the group consisting of hydrogen and alkyl radicals containing about 1 to 3 carbon atoms.

Wet Aluminum Pigment

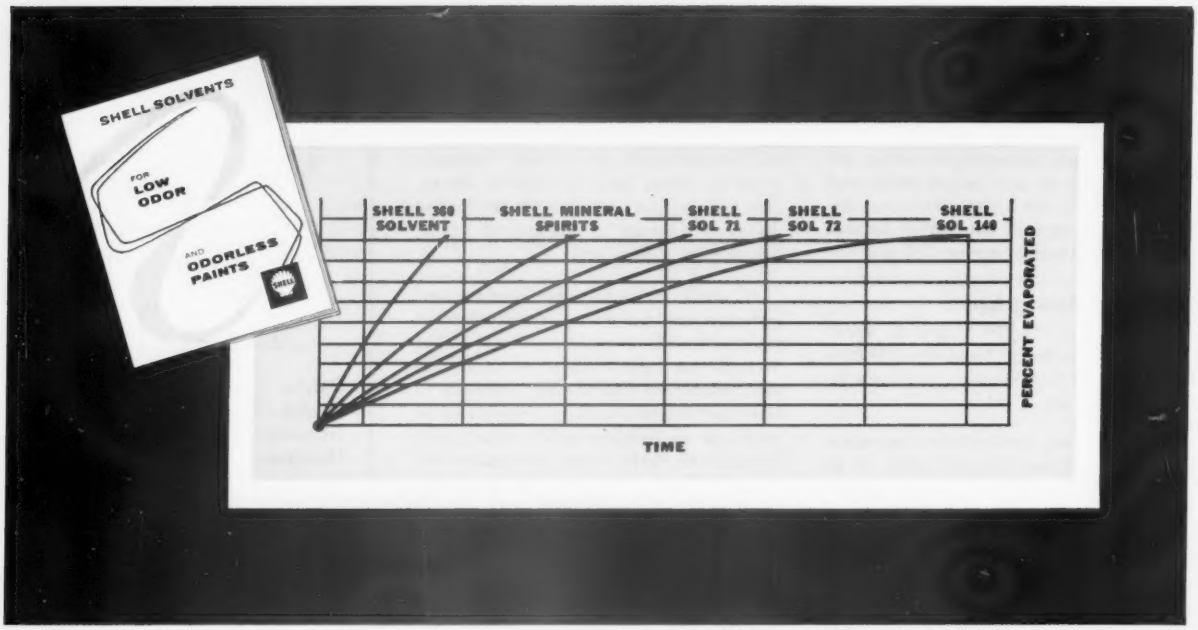
U.S. Patent 2,858,230. Alexander F. Knoll, Westfield, and Loren C. Hurd, Basking Ridge, N.J.; Eleanor Holbrook Hurd, executrix of said Loren C. Hurd, deceased, assignors to Metals Disintegrating Co., Inc., Union City, N.J., a corporation of New Jersey.

The process of making wet aluminum pigment containing non-leafing aluminum flake particles in contact with water which comprises the attrition of aluminum to form aluminum flake particles in the presence of a lubricant while contacting said metal, and the particles so formed, with an aqueous solution consisting essentially of available PO_4 ion in an amount of at least about 0.7 percent by weight of the weight of the metal, said PO_4 ion being furnished in said aqueous solution from a compound selected from the group consisting of phosphoric acid and ammonium, alkali metal, alkaline earth metal, zinc and magnesium salts of said acid, the said aqueous solution having an acidity within the range indicated by a pH of about 1.5 to about 11.

Vinyl Halide Resins

U.S. Patent 2,857,348. Frank C. Magne, Evald L. Skau, and Reuben O. Feuge, New Orleans, La., assignors to the United States of America as represented by the Secretary of Agriculture.

A vinyl chloride-vinyl acetate copolymer predominating in polymerized vinyl chloride containing from about 50 to 66 parts per hundred parts of resin of a plasticizer comprising a mixture of one part of a non-volatile liquid neutral ester of phosphoric acid mixed with from about ¼ to 1 part of a mixed triglyceride consisting essentially of diaceto-olein.



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foreign developments

British Research on Epoxidized Oils

Lead Titanate Paints in Holland

British paint investigators searching for a less expensive source of epoxy groups are utilizing epoxidized oils to prepare unique alkyd-type coatings. For details of this new development, see page 91.

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A New Development from England—

Surface Coatings from Epoxidized Oils

Part I

OF the thousands of chemical reactions to which an organic chemist may devote a lifetime of study, there are probably not more than a dozen which are widely used by the protective coatings industry. As is well-known, the reaction which is probably most basic in the manufacture of protective coatings is esterification. For it is this reaction which provides varnishes, reconstituted oils and alkyds. Indeed, it is this reaction which nature used to provide drying oils which are, of course, esters of glycerol and unsaturated fatty acids.

The first important departure from traditional drying oil chemistry—nitrocellulose—also made use of esterification, since nitrocellulose is an inorganic ester resulting from the interaction of cellulose with nitric acid. As the paint industry has grown, however, the need has developed for coatings with properties beyond those provided by esterification reactions. Thus the paint chemist has combed the organic chemical literature to see how he can make use of other reactions—amidifications, etherifications, condensations of all sorts—to enlarge the vistas and fill the ever-increasing needs of this virile industry.

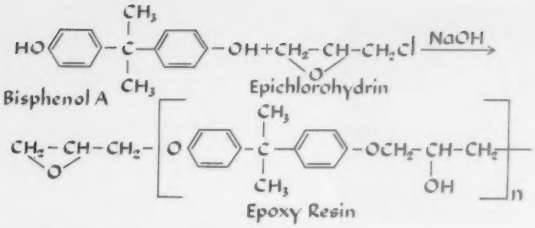
One reaction which has intrigued the organic chemist and the paint chemist alike is the reaction between molecules containing epoxy groups and molecules containing active hydrogen atoms. The permutations and combinations here are manifold and the paint chemist takes advantage of these when he utilizes the epoxy resins which are now such a vital part of his industry. Thus, the reaction of the epoxy groups in epoxy resins with di- and polyamines and with the amine groups in polyamide resins is well-known. The epoxy groups may be reacted with anhydrides or with carboxylic acids, or they may undergo a complex reaction with the methylol groups available in certain phenolic, urea, and melamine resins.

Epoxy resins are relatively expensive raw materials for the paint chemist. The epoxy resins of commerce are an example of how an epoxy group may be introduced into a molecule indirectly rather than by direct epoxidation. To manufacture the epoxy resins as we know them today, it is necessary to use an epoxy compound, epichlorohydrin. This is a difunctional compound which is condensed with another difunctional compound, bisphenol A, as the following equation indicates:

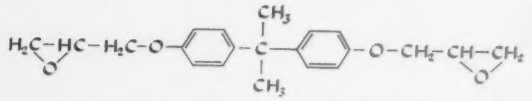
This is the first in a series of articles, prepared by the staff of this magazine, reporting on a new European development involving reactions of epoxidized soybean oil. That the paint chemist may appreciate the full significance of this development and hopefully extend it, the article has been embellished with a discussion of the extensive chemistry of epoxide group to stimulate the imagination of the creative American paint chemist.

This part is concerned with the preparation of epoxy compounds and the chemical reactions of the epoxy group. Part II, scheduled for the January number, will deal with more chemical reactions of the epoxy group.

The Editor



Alkali is used to drive the reaction forward; and the net result is the condensation of the two difunctional reagents into a polymer, with the elimination of the elements of hydrochloric acid and the formation of a material in which the end groups are epoxy groups.



In the simplest situation, one can postulate the condensation of two molecules of epichlorohydrin with one molecule of bisphenol A to give the following material which is a nonresinous diepoxy compound. Actually, some of the epoxy "resins" available today approximate this structure. It can be seen, however, that the introduction of epoxy groups by an indirect method, such as the one used for the preparation of epoxy resins, is basically expensive, since one of the ingredients of the reaction is a compound (epichlorohydrin) which has already been prepared by a direct epoxidation procedure.

Thus, in the past few years, the paint chemist has been searching for a less expensive source of epoxy groups. Our fellow paint chemists in England may have the answer, for they have been able to utilize epoxidized oils, such as epoxidized soybean oil, to prepare unique alkyd-type coatings. Epoxidized soybean oil is a relatively inexpensive material which has been used commercially for about eight years as a stabilizer and plasticizer for polyvinyl chloride (1). Coincident with the development of epoxidized soybean oil has been the development of epoxystearates, such as butyl or octyl epoxystearates for the same uses. The simple esters are better plasticizers, but they are somewhat more expensive. The combined market for these materials, the bulk of which is enjoyed by epoxidized soybean oil, was estimated in 1957 to be about 30 million pounds (2).

In this article, we shall discuss:

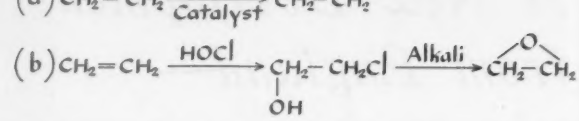
(a) the methods for preparing epoxidized soybean oil,

(b) the chemistry of the epoxy group and,

(c) the new applications of epoxidized soybean oil to the protective coatings industry as worked out by certain British paint investigators.

Preparation of Epoxy Compounds

The simplest epoxy compound known is ethylene oxide, $CH_2\text{-}CH_2$ (with O). This commercially available compound has been known for many years and is made rather simply from ethylene by one of the two following reactions:



The first reaction above, the direct oxidation with air, seems to be specific for the preparation of low molecular weight epoxides. As far as is now known, little success has been achieved in attempting to apply it to the preparation of high molecular weight compounds. The second reaction—hypochlorous acid addition to a double bond followed by dehydrochlorination—is of a more general nature; although it presents certain processing difficulties with double bonds in high molecular weight compounds.

It was discovered long ago, however, that perbenzoic acid, C_6H_5COOOH, (3) will convert virtually any olefin to an epoxide. The investigation of other peracids followed, and one which was studied extensively was peracetic acid. Two Russian investigators (4) were able to show that peracetic acid also converted double bonds to epoxy linkages if the peracetic acid was used in an inert solvent such as ether. Work which led to the commercialization of this reaction and its use to prepare compounds like epoxidized soybean oil can be attributed to several American workers, including Wheeler and Terry (1), Niederhauser and Koroly (5), and Swern and his co-workers (6). The latter group worked under the sponsorship of the government at the Eastern Regional Utilization Branch Laboratory of the Department of Agriculture.

Whereas Wheeler and Terry, and Swern and his coworkers worked with peracetic acid dissolved in acetic acid, Niederhauser and Koroly carried out epoxidations using performic acid. In both instances, the peracids were obtained by the reaction of acetic or formic acid with hydrogen peroxide according to the following basic reaction:

$$CH_3COOH + H_2O_2 \longrightarrow CH_3COOOH + H_2O$$

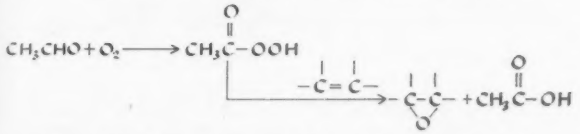
These reactions provided the basis for the first commercial preparation of epoxidized soybean oil and related esters, although a variety of improvements in techniques has been reported. For example, Greenspan (7) showed that 90 per cent hydrogen peroxide instead of the more dilute reagent used by previous workers could be readily converted to a peracetic acid solution containing approximately 45 per cent of the reactive material.

Industrially, emphasis has been given to "*in situ*" reactions, in which the peracid is formed from its constituents in the presence of the material to be epoxidized. The Niederhauser-Koroly procedure mentioned above was basically an *in situ* method.

Gall and Greenspan (8) found that strong acid catalysts were helpful in converting hydrogen peroxide and acetic acid to peracetic acid, and suggested the use of sulfuric acid and ion exchange resins for *in situ*-type epoxidations. The DuPont Co. has described the ion exchange resin method (9), which also provides for *in situ*-type epoxidations by using an ion exchange resin derived from crosslinked sulfonated polystyrene. The resin contains within it all of the ingredients for the reaction, including the sulfuric acid, the hydrogen

peroxide, and the water. In addition, it serves as the catalyst because of its strong sulfonic acid groups. The oil which is to be epoxidized, however, is made up of such large molecules that it cannot enter the ion exchange resin, and accordingly, a two-phase system—solid and liquid—exists. Basically, all of the methods described above are two-phase systems, and the bulk of the commercial operations carried out today rely on such systems for success.

Recently, the Union Carbide Chemicals Co. (10) has described a unique procedure for obtaining peracetic acid for epoxidation reactions. It will be recalled that all the above reactions are based on the interaction of hydrogen peroxide and an organic acid such as acetic or formic acid. The Carbide method makes use of the air oxidation of acetaldehyde, a procedure used commercially to a wide extend to manufacture acetic acid. Presumably, this oxidation proceeds through a peroxide intermediate of the peracetic acid type. The Carbide research has resulted in a procedure for obtaining peracetic by this method. Theoretically at least, the raw material cost is negligible, for when one uses the peracetic acid as an epoxidizing agent, a mole of acetic acid results as a co-product for each mole of acetaldehyde originally used. The basic reactions are indicated below.



The chemistry of epoxidation is summarized in several good reviews (6A,9,10,11). This chemistry is utilized today to prepare epoxidized soybean oil and related compounds in multimillion pound quantities. There are at least eight producers of epoxidized soybean oil and epoxystearates. These include Archer-Daniels-Midland, Argus Chemical Co., Celanese, General Mills, Inc., Ohio Apex Division of Food Machinery Company, Pittsburgh Coke & Chemical Co., Reichhold Chemical Corp., and Rohm & Haas.

As already indicated, the primary use of epoxidized soybean oil is as a vinyl plasticizer and stabilizer. The stabilizing action results from the epoxy group which reacts with the small amounts of hydrogen chloride liberated from the polyvinyl chloride resins. The plasticizing action results from the polarity contributed to the molecule by both the ester and the epoxy linkages.

Initially, the epoxidized soybean oils were considered as secondary plasticizers and were used primarily for their stabilizing action in conjunction with the more conventional plasticizers such as dioctyl phthalate. Improvement in manufacturing technique, as well as a better understanding of the utility of these materials, has led to the inclusion of epoxidized soybean oils in various vinyl formulations in large quantities so that they now may serve as major portions of the plasticizers present.

Chemical Reactions of the Epoxy Group

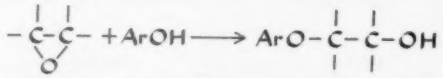
As indicated above, the utilization of the epoxy group by the paint chemist depends on a thorough understanding of the chemistry in which the epoxy group may be involved. The preliminary work which has been carried out in England and which is described below is certainly not the last word on the subject. There is a marked opportunity in this new field for the paint chemist who is well versed in both chemistry of the epoxy group and the chemistry of the available coreactant materials to utilize his knowledge to produce unique coatings as yet unknown to the paint field. With this thought in mind, a number of the important reactions which the epoxy group undergoes will be described. These reactions have been enumerated in even greater detail in a Union Carbide Technical Service Bulletin (10). The reactions described below, however, are the ones which could conceivably be of interest and of value in protective coatings formulation.

It must, of course, be realized that all epoxy compounds will not undergo all of the reactions mentioned below. Also, the success of many of these reactions depends on the determination of exact conditions, including reactant ratios, temperatures, solvents, and catalysts. Frequently, information pertaining to these important points can be found in the references indicated.

The epoxy group reacts with alcohols according to the following equation (12):

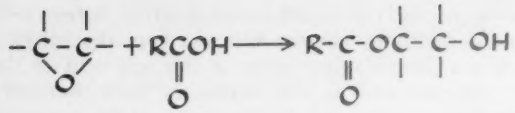
The alcohol group is available to the paint chemist in simple compounds such as ethyl alcohol and butyl alcohol, and in more complex compounds such as the glycols and polyhydric alcohols, including ethylene glycol, glycerol, pentaerythritol, and sorbitol. The alcohol group is also the characteristic end group of the ethylene oxide polymers, such as the "Carbowaxes" which are long chain ethers of varying molecular weights. An important source of hydroxyl groups is the resin family known as polyesters, which may include the alkyd resins as well as condensates of dibasic acids and glycols, such as maleic anhydride and diethylene glycol.

Just as epoxy groups react with alcohol groups, they also react with phenolic groups according to the following equation (13):



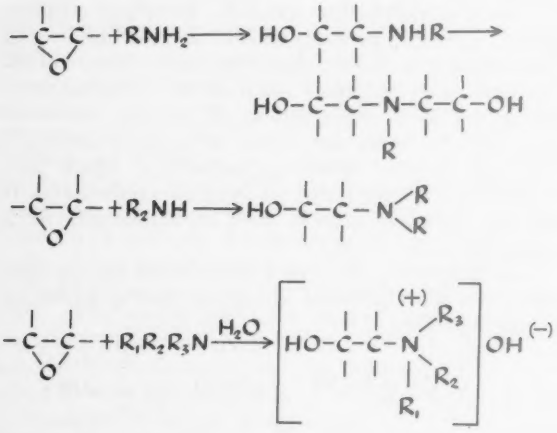
The phenolic group is, of course, found in the simple phenols such as phenol itself and in cresol. It is also found in difunctional compounds such as bisphenol A—the backbone of the epoxy resins—and in phenolic resins, scores of which have been available for many years primarily for use in varnish formulation. An interesting phenolic compound is trimethylolphenol, now available on a development basis. This compound, which for years has been difficult to prepare, is presumably the first stage in the condensation of formaldehyde and phenol to yield phenolic resins. A phenolic intermediate based on the interaction of allylphenol and formaldehyde is also of interest to the protective coatings chemist.

The reaction of the epoxy group with carboxylic acids is well-known and is indicated in the following equation (14):



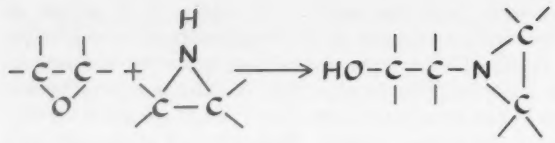
Carboxyl-containing compounds are also well-known to the paint chemist, since they are the major functional group of the fatty acids used in alkyd preparation, in the preparation of epoxy resins esters, reconstituted oils, core oils and in certain *in situ* varnishes. Similarly, the carboxyl group is characteristic of rosin, which is used as such in varnishes, in making rosin esters for varnish preparation, and in the preparation of certain alkyds and other protective coating vehicles. Tall oil is, of course, a mixture of fatty and rosin acids, and because of the vast production of tall oil, carboxyl-containing compounds for the protective coatings industry are now available at very low cost. Carboxyl groups may also be available as end groups in alkyd resins and in polyesters derived from dibasic acids and glycols. Actually, whether the end group of a polyester is an alcohol or a carboxyl depends on whether the glycol or the dibasic acid has been used in excess. Benzoic acid and related aromatic acids used in short oil alkyd formulation as chain stoppers are also a source of the carboxyl group.

The epoxy linkage reacts with primary, secondary, and tertiary amines according to the following equations (15, 16, 17):



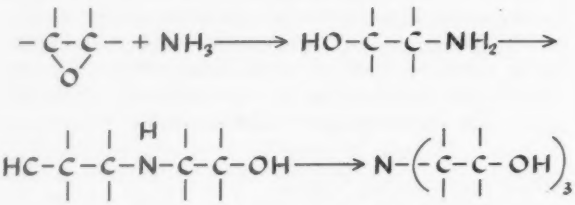
Although amine compounds do not enter into protective coatings chemistry to the extent that alcohol, phenolic, and carboxyl groups do, they are still quite readily available. Thus, one finds amine groups in simple compounds like methylamine or aniline. Difunctional amine compounds are available in diethylene triamine and aromatic materials like phenylene diamine. The ethylene diamine polymers, such as diethylene triamine, triethylene tetramine, and tetraethylene pentamine, are actually polyfunctional amines. Ethylene imine polymers, which are thus far available only on a development basis, also provide interesting polyamine compounds.

The reaction with ethylene imine itself proceeds as indicated by the following equation (19):



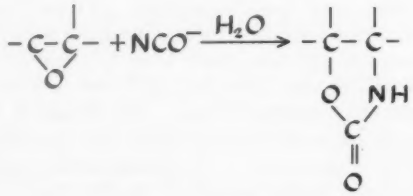
A group of low molecular weight polyamide resins is available in which the amine group is present not only as an end group but also along the chain. These resins have found utility as coreactants with epoxy resins where corrosion-proof coatings with a high degree of flexibility, impact resistance, and adhesion are required. Melamine and a variety of related derivatives now available are all sources of amine groups for interesting reactions, as, of course, are the well-known polymers based on the condensation of urea or melamine with formaldehyde.

In a special category related to the amine reaction is the reaction of the epoxy group with ammonia as indicated by the following equation (18):



As this equation indicates, it is possible for the initial hydroxyl amine which forms to react with further epoxy linkages until there results a tertiary amine.

Of interest in the interaction of the epoxy group with inorganic cyanates as the following equation demonstrates (20).



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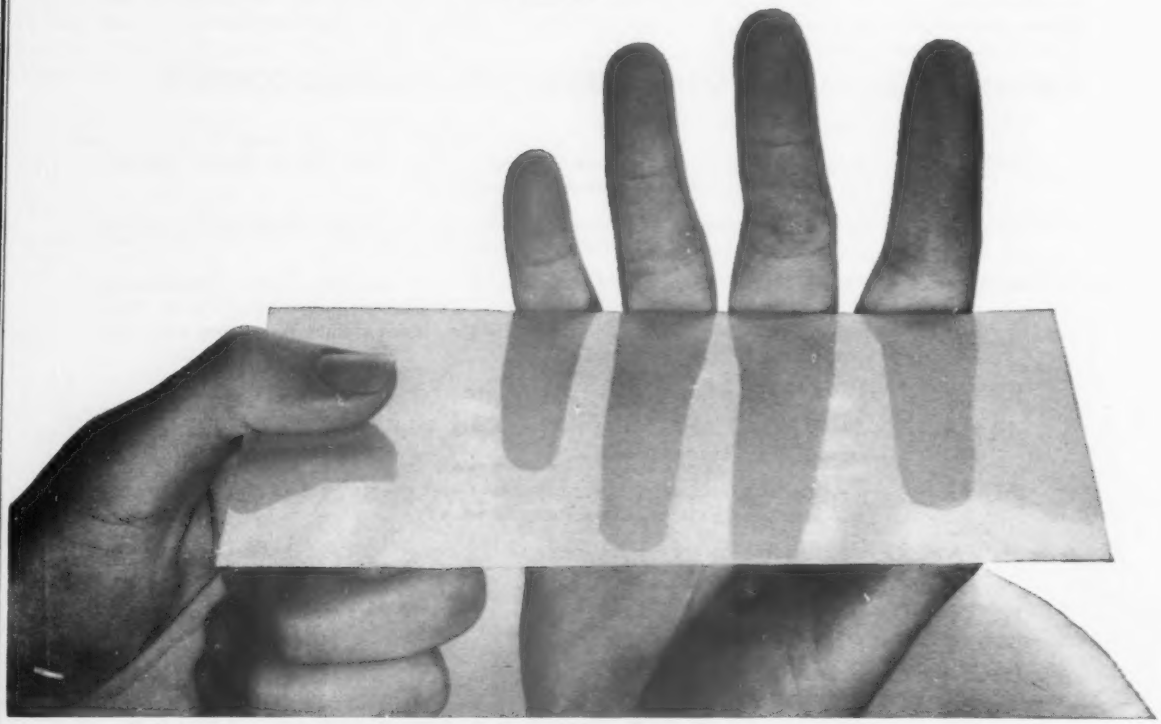
high gloss



EXCELLENT GLOSS of an industrial enamel made with Ti-Pure® R-110 is dramatized above. This durable pigment resists discoloration on baking . . . combines high brightness with outstanding hiding power and color.

Progress in Pigments

Lead Titanate Paints in Holland

By
Dr. J. Rinse*

Dutch liner Gooiland in dry-dock about to be coated with lead titanate paint.

After lead titanate ($PbTiO_3$) became available commercially in the United States in the late thirties, it was evaluated in Holland. By comparative weathering tests it was soon recognized as one of the most durable white pigments.

Actually, it is not completely white but has a light yellow greenish hue which painters call broken or antique white. This shade is not objectionable because most houses in Holland are not painted a brightly white, but are tinted with a more or less yellowish color.

Before the War, the application of lead titanate in Holland had grown rapidly. It was used in paints for houses, official buildings, plants, tunnels (Maastunnel at Rotterdam) and even for seaships. When war started in 1939 and shipments of the pigment from U. S. A. were terminated, a process of manufacture was developed in Holland utilizing part of the remaining stocks of white lead and titanium pigments in the preparation of the titanate. Later, in 1942, since no more raw materials were available, production was stopped, until in 1946 when it was resumed. Present consumption is now more than 500,000 lbs. per year.

The acceptance of a more durable paint was easy with consumers who were dissatisfied by the old methods of repainting every three or four years. Some conservative paint manufacturers, wishing to produce only their more important line of stand whites and the renowned white lead paints, objected and tried to delay this new development by commenting that they needed production. A paint with a longer life was not in their interest. Other manufacturers were more sensible and produced what was specified by the consumers and their advisers.

Gradually when home-owners and the technical supervisors of municipalities, particularly of housing developments, became acquainted with the considerable possible extension of the life of paint coatings containing lead titanate, the conservative manufacturers, began to show interest in these new paints. Finally, the Dutch Ministry of Reconstruction also became interested and organized, through the intermediary of the semi-official organization for applied research (TNO), a large scale testing program by painting a dozen houses in Rotterdam with the classic as well as with modern paints. After three years the results were clearly visible. The modern paints were still in perfect condition and the renowned classic paints were considerably weathered. The test was continued for seven years and the lead titanate-alkyd paints were still in good condition with rutile titanium alkyd paint on lead titanate primer running a good second. Little was left of the classic paints. They had completely cracked and lost their protective value. The life of a lead titanate alkyd paint appeared to be more than double that of the best white lead or zinc oxide paints.

Objection may be raised that these results are not reproducible in other countries because of a different climate. Therefore, in 1952 a new house was painted in New Jersey with imported Dutch lead titanate paints. Thus far the behavior of the paints is quite similar and after six years it is still in good condition.

Properties

Most houses in Holland are built of brick, but the roofs, gutter supports, overhang, window frames, doors, etc. are made usually of wood, which has to be protected by paint against weathering. This paint is required to dry with a gloss and much attention is being given to the priming, filling of holes, sanding and overpriming in order to obtain a smooth surface. Accordingly, the top coating should level well. Drying should not be too long, preferable not over 6-8 hours dry to touch. The consistency

*Chemical Research Associates, Inc., Bernardsville, N. J.

of the Dutch paints is heavier than our paints because Dutch painters use stiff round brushes for spreading the paint with some pressure. A paint of a loose structure would spread out too much, causing a low-hiding thin coat. However, recently the newer thixotropic, easy-brushing paints are gaining wide interest.

Composition

The composition of Dutch paints differs considerably from U. S. paints. Extenders are seldom used in exterior paints and the pigment content is kept to a minimum, adequate for hiding and allowing a good gloss. Pigment volume concentration (pvc) of an exterior paint is around 20%, sometimes as low as 12%, because it was observed that durability decreases at higher pvc. Contrary to U. S. presumptions, a self-cleaning surface by more or less controlled chalking is not wanted in Holland. Dirt accumulation is limited to some industrial areas. Removal of dirt by washing is considered preferable to repainting an eroded coating.

A paint layer with a good gloss retention and adequate permanent flexibility lasts longer than a flat brittle coating. It is in this application that lead titanate very soon proved that it was superior to the active pigments based on zinc oxide or white lead. A paper in Official Digest of 1935 by Jacobsen furnishes several interesting data.

Figure 1 indicates the change in elongation on exposure.

Flexibility tests were published by J. Rinse in Paint Technology 1948, No. 5 (See Table I). Figure 2 shows the results of a panel test of zinc oxide and lead titanate paints. Figure 3 is a graph of the gloss determinations of the panel (Figure 2).

A classic Dutch stand oil paint is composed mainly from:

50 p.b.w. of zinc oxide, 35 p.b.w. bodied linseed oil.

15 p.b.w. of turpentine or white spirit. This means a p.v.c. of 21%.

A modern Dutch lead titanate paint is composed from:

40 p.b.w. of lead titanate

40 p.b.w. of long oil alkyd (15-20% p.a.)

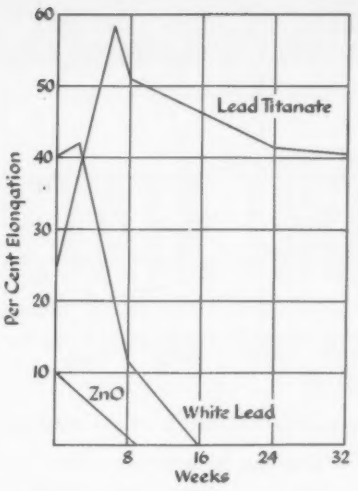


Figure 1. A plot of the change in elongation on exposure.

20 p.b.w. of mineral spirits
The p.v.c. is 12%.

Lead titanate has excellent suspension and high hiding properties, but does not impart much thixotropy to a paint. Accordingly, the paint has a tendency for sagging which can be corrected in several ways, i.e. by minor changes in the vehicle or by addition of a small quantity of magnesium-or silicate compounds or more recently by a thixotropic agent—by preference of the chemically reactive type (aluminum acylates).

Another feature of the pigment is its compatibility with colors. Fading is greatly reduced and e.g. blue paints of high durability have been made with lead titanate and phthalocyanine blue.

In one respect lead titanate is inferior to the classic pigments, i.e. by its sensitivity to fungus. In areas where fungus develops easily, it is necessary to add a fungicide, e.g. a mercuric compound or copper oxychinolate to the paint. It is not recommended to add zinc oxide, which itself exerts fungicide activity, because the coatings from such paints invariably will crack early even with a zinc oxide contents as low as 2-5%.

The vehicle for lead titanate may be a bodied linseed oil with 20% tung oil for adequate drying, but best results have been obtained with long oil alkyds or with mixtures of medium oil alkyds and bodied linseed oil. Percentage of phthalic anhydride in the vehicle may vary from 12-25%.

Ship Paints

For applications where high water resistance is required, e.g. ship paints, the use of styrenated linseed oil (35% styrene) has been successful. Since 1947 the fleet of the Royal Dutch Lloyd, consisting of a dozen Liberty ships sailing

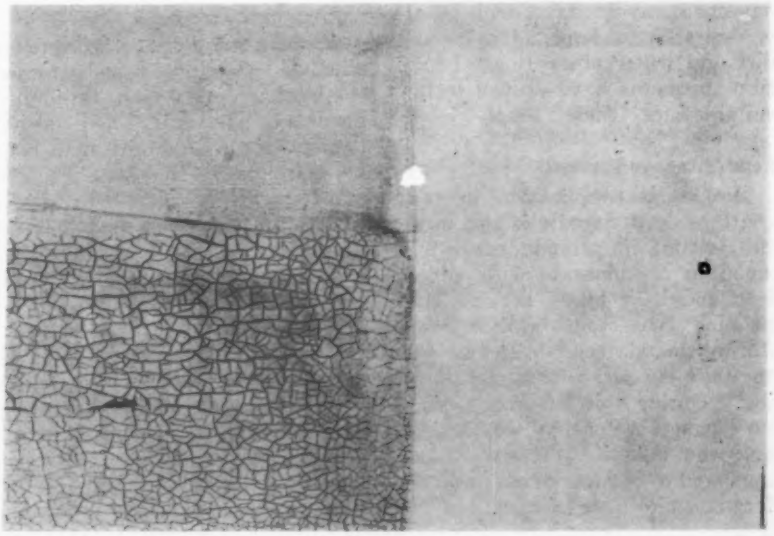


Figure 2.

Zinc Oxide: stand oil paint **Lead titanate: alkyd resin paint**

Comparison of conventional and modern paints after two years' exposure at 45° south. Two different priming coats were used. The zinc oxide paint cracked on both primers; the lead titanate paint neither cracked nor chalked, but kept a slight gloss.

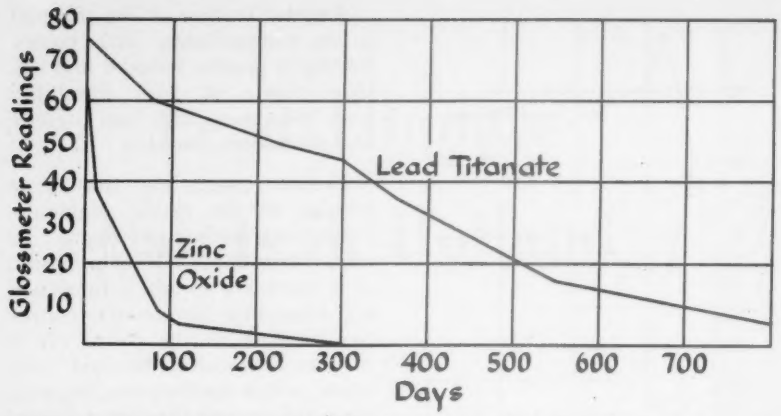


Figure 3. Graph of gloss determinations of panel (figure 2) upon exposure.

between Europe and South America, has been painted with lead titanate styrenated oil paints. The red lead primer contains the same vehicle. These rapid drying and water resistant coatings are not damaged when a ship which has been painted in the morning, leaves for sea in the afternoon or evening. Such ships have been inspected when they returned several days later and the coating was found in good condition. Instead of styrenated oils, alkyds of high water resistance have been used recently.

The durability of a ship paint depends upon the action of sun and water as well as upon mechanical influences and dirt accumulation in polluted harbors. Softness and its opposite brittleness have to be avoided. A high gloss is desirable to limit adhesion of dirt and water absorption. Lead titanate paints have proven to be suitable for these tough jobs.

Lead Titanate Primers

Besides its application in top coatings, lead titanate is also used in Holland in priming coats for wood in combination with white lead and inert fillers, because the priming coats can be left over during the winter or longer before they are covered with a top coating. During this left-over period no damage is done by weathering and the adhesion on wood also appeared to be superior over that of former white lead primers.

Comparison with Rutile TiO_2

The experience with titanium dioxide paints in Holland is unfavorable compared with lead titanate. The gloss retention of the latter is better and moreover the chalking even of low p.v.c. rutile titanium dioxide paints, is much more pronounced and frequently unpredictable. Accordingly, a titanium white paint will erode faster than and is less reliable as a lead titanate paint.

Preparation of Lead Titanate

The pigment is prepared by calcining at 600-800°C intimate mixtures of lead and titanium oxides or hydrates, e.g. 27 parts $Ti0_2$ and 73 parts Pb0, in the presence of a catalyst to prevent dark colors.

Rotating or batch ovens are used and a strict temperature-time schedule is required to achieve complete reaction and optimum fineness of particles. The pigment is manufactured at present in two Dutch plants and in one French plant.

The uses of lead titanate have been discussed as a pigment for exterior finishing paints for wood and steel, and in primers for wood. The superior durability against weathering has led to its general acceptance in Holland. Doubling the life of exterior paint coating has resulted in the use of this pigment. Differences by requirements between United States and Dutch house paints have been indicated.

Period of Exposure in Months	0	0.5	1	2	3	4	5	6	7	8	22
Zinc Oxide Paint	10	10	10	5.5	4.5	3.4	2.0	1.8	1.6	1.0	0
Lead Titanate Paint	10	10	10	10	10	10	10	10	10	10	10

Table I. Comparison of elasticity of zinc oxide paint and lead titanate paint.

ounces Unique Sugar Derivative...Offered in Commercial Quantities

SUCROSE ACETATE ISOBUTYRATE

Unusually high solids content lacquers now possible with SAIB, new Eastman resin extender

Here is a new chemical product, Sucrose Acetate Isobutyrate (SAIB), so unlike any known product that its performance characteristics are difficult to classify. Generally, however, they lie between those of a plasticizer and a resin.

Heavy, Compact Molecule

SAIB is made by esterification of sucrose with acetic anhydride and isobutyric anhydride. The result is a clear, extremely viscous liquid of high molecular weight (847). In fact, SAIB is believed to be the heaviest monomeric organic molecule available on a commercial scale. Despite its high molecular weight, SAIB has a singularly compact molecular structure.

Figure 1

Good Permanence

This molecular compactness provides SAIB with outstanding thermal and hydrolysis stability. For example, after six days at 350°F, SAIB shows a change in Gardner color from 3 to only 10. Hydrolysis, after refluxing in water for 4 days, amounts to less than 0.35%.

Viscous, Soluble, Compatible

SAIB is so viscous at room temperature (100,000 cps at 30°C), its characteristics approach those of a semi-solid. Viscosity changes rapidly with temperature, however, dropping to 90 cps at 100°C. The extreme solubility of SAIB is indicated by the low viscosity (750 cps at room temperature) of a solution of 90 parts SAIB in 10 parts of ethyl alcohol. *(See Figure 1)* It is in this 90% SAIB/10% ethyl alcohol solution, as well as in the 100% concentrate, that Eastman markets SAIB. In addition to its good solubility, SAIB is compatible with a broad range of resins, plasticizers, oils and waxes.

High Solids Lacquers

SAIB has been evaluated in wood lacquers, paper coatings, cloth coatings, metal lacquers and plastic lacquers. In such formulations, its low solution viscosity permits higher non-volatile content without exceeding application viscosities. For example, the solids content of a lacquer system based on ½ sec. RS nitrocellulose can be increased from 20 to 33% by replacing half the nitrocellulose with SAIB, with no increase in viscosity. Thus, greater coverage per gallon of lacquer can be achieved with reduced solvent requirements.

SAIB is unique in its ability to extend lacquer formulations with no loss of film hardness. *(See Figure 2)* Nitrocellulose films can be modified with up to 50% SAIB without decreasing film hardness, with maximum hardness occurring at 25% modification. Castor oil-modified films, on the other hand, do not change appreciably in hardness up to 25% plasticizer content and decrease sharply beyond this point. Dibutyl phthalate causes an immediate, rapid drop in Sward hardness.

Sward Hardness of Plasticized Films of RS ½ sec. Nitrocellulose

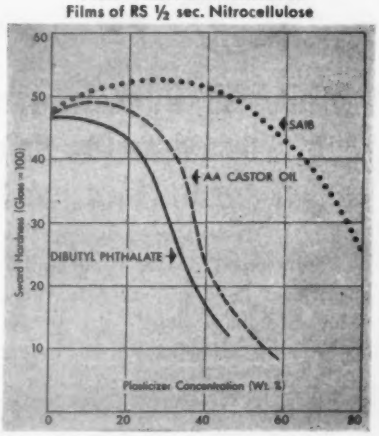


Figure 2

A newly-published bulletin on SAIB, containing physical properties and typical solvent coating formulations, is available. For your copy and a sample of SAIB write to Chemical Sales Development Department, Chemicals Division, Eastman Chemical Products, Inc., Kingsport, Tennessee.

SAIB
SUCROSE ACETATE ISOBUTYRATE

Eastman CHEMICAL PRODUCTS, INC., KINGSPORT, TENNESSEE, subsidiary of Eastman Kodak Company

 (*From page 49*)

withstand fabrication which is employed for screw cap production and for small metal stampings.

Aluminum Awning Coatings

Pigmented acrylic paints are particularly satisfactory on the new aluminum awnings used extensively in all parts of the United States. These coatings are applied to the flat aluminum sheet by roller coating and are then baked. Subsequent forming of the sheets into the desired shape does not harm the coatings. Colorful, attractive awnings are thus produced and the coatings have long service lives.

Acrylic Automotive Finishes

Within the last two years acrylic finishes for automobile bodies have been used for commercial production to replace nitrocellulose lacquers. It is too early to obtain a complete story on the durability of such finishes but accelerated tests in Florida indicate that the acrylic automotive finishes are considerably better gloss and color retention than nitrocellulose lacquers. The finishes resist staining by road tar and they can readily be spot-patched by repair shops when needed.

Specialty Pigmented Coatings

Acrylic polymers are used for many specialty coatings. For example, luminescent type coatings are commonly made with acrylic bases. Since the acrylic polymer is neutral it does not react with sensitive fluorescent and phosphorescent pigments. These pigments are known as fluorescent pigments when they glow during exposure to ultra-violet (black) light. Phosphorescent pigments continue to glow in the dark after exposure to light, either daylight or artificial light. Such coatings are very useful to the industrial designer who wishes to add nightime visibility to switches, exit signs, automotive and aircraft instrument panels.

For best visibility a white acrylic coat should be applied first to the article. A luminescent coating is applied and allowed to dry thoroughly. A clear acrylic topcoat should then be added to assure long life, particularly for outdoor service.

Dulling Spray for Photography and TV

An unusual application for acrylic finishes is in a dulling spray to eliminate reflections when highly polished surfaces are photographed. All three of the major TV networks use such coatings to prevent "blind spots" for viewers. While acrylic sprays can dull a bright surface, someone said, "Even the magic of acrylic cannot brighten up a dull TV program."

Acrylic and methacrylic solution polymers are available with a wide range of flexibility, hardness and toughness properties. Pigmented and clear finishes made from these polymers show exceptional retention, durability outdoors, chemical and fume resistance and minimum pigment reactivity.

These acrylic solution polymers are used in many types of specialty coatings, particularly heat resistant white enamels, water clear finishes for polished metals and durable automotive type finishes.

Acknowledgements

Grateful acknowledgement is made to Dr. S. Gusman and Mr. Lewis Wetzel of the Rohm and Haas Company Laboratories who compiled the data used in many of these tables.

NEWS

NEWS OF COMPANIES, ASSOCIATIONS
TECHNICAL GROUPS
ITEMS OF GENERAL INTEREST

71st Annual NPVLA Meeting

The 71st Annual Meeting of the National Paint, Varnish & Lacquer Assn. was held at the Shoreham and Sheraton-Park Hotels, Washington, D. C., Monday—Wednesday, October 27-29.

The Monday morning program of the advertising and sales promotion managers' forum at the Shoreham featured papers by George V. Wise, John W. Masury & Son, Inc., on *Color Committee Report*, and Ted Deglin, Ted Deglin & Associates, on *NPVLA Publicity and Public Relations*. Also presented was a paper entitled, *Survey of New Multi-Million Dollar Market* by Mrs. Jan Harmer and M. H. P. Morand of the Dow Chemical Co.

Mr. Morand pointed that by 1970 there will be a 71 per cent increase in the teenage population over 1955. He urged his audience to capitalize on this market. Mrs. Harmer outlined how members of the paint industry could verify for themselves the sales value of the promotional effort in this direction.

General Joseph F. Battley

The roof coating and roof cement manufacturers' forum held Monday morning at the Sheraton-Park featured talks on *Developing New Products* by Helge Holst, Arthur D. Little Inc. and *A Selling Expense Reducing Spree* by Byron F. Swackhamer, Yarnall Paint Co.

The highlights of the first business session on Monday afternoon was the *President's Address* given by General Joseph F. Battley.

General Battley outlined the activities of the Association's headquarters in Washington and voiced optimism about the future of the world and the future of the paint industry. He stated that great and profitable years loom directly ahead of us.

Another informative talk in the first business session was given by the Hon. Harold C. McClellan, former Assistant Secretary of Commerce, Old Colony Paint and Chemical Co. His paper was entitled, *The Businessman's Responsibility in Public Affairs.*

Mr. McClellan's scheduled talk to be delivered from the American Embassy in Moscow via radio-relay telephone had to be cancelled due to mechanical failure. Fortunately, a tape of the talk was available and was substituted. Mr. McClellan advised businessmen to take a greater interest in public affairs.

The 1500 paint manufacturers were also urged by General Battley to step up their merchandising in order to meet the aggressive competition of other industries fighting for larger share of the consumer dollar. He warned against complacency that could result from the paint industry's scientific and technological progress.

For all who did not attend management workshop sessions Tuesday morning, there was a general forum session held at the Shoreham. A discussion of *Effective Communications in Business* was presented by Dr. Ernest Dale of Cornell University.

The management workshop session included a variety of papers on chemical coatings, trade sales, and general subjects.

The final business session was held Wednesday morning, October 29. Featured was a presentation of *"Hidden Powers" Sales Training Program*, Henry Behnke, vice chairman, special committee on sales training, Mautz Paint & Varnish Co.

This presentation, in the form of a playlet, outlined various sales techniques which should be employed in the selling of paint.

The final paper of the business session was given by Leo Cherne, executive director, Research Institute of America. His talk, entitled *The Fabulous and Critical 60's*, pointed out that there will be a boom in the 60's accompanied by a population growth. Business will be "way–up." However, our economy will be threatened by Russia who will be a strong economic competitive force.

EPOXY SPRAY COATING: The spray equipment's ability to handle fast curing epoxy formulations make it ideal for such applications as large tanks or marine equipment. The epoxy coating shown being applied to a filtration tank is expected to remain serviceable for many years of rigorous weather conditions. This new concept in epoxy spray coating was featured by the Union Carbide Plastics Co. at the 1958 Paint Industries Show.

Baltimore Club Meets

The Baltimore Club under the direction of their new president, Myron O. Beatty, held it's October meeting at Marty's Park Plaza, October 10, with 60 members and guests present.

Jim Stanton, manager of the Oil Technical Service Laboratory, Research Department of Cargill, Inc., presented a paper along with slides on "Oil Modified Urethane Polymers."

General Joseph Battley was elected to honorary membership of the Baltimore Club.

NEWS

Paint Technology Course Announced by U. of Fla.

The program and registration information for the third Short Course in Paint Technology at the University of Florida have been announced by Henry F. Payne, professor in charge of organic coatings research and technology. The course will be given February 2-6, 1959 and is sponsored by the University in cooperation with the Southern Paint & Varnish Production Club.

Henry F. Payne

The course is open to all who believe they may benefit from the program. Registration fee is $25.00; check payable to University of Florida and send to Henry F. Payne, Chemical Engineering Department. A copy of the complete papers presented at the course will be sent to registrants at least two weeks before the course begins. This will enable registrants to become familiar with the subject matter and be better prepared for discussion. The registration fee includes the cost of the papers and dinner on Wednesday, Feb. 4, but not other meals or accomodations. Details of housing facilities will be sent to registrants.

The program is as follows:

Monday, February 2

8:30– 9:00 Registrants Check-in—Room 207, Leigh Hall

9:00–10:00 Principles of Corrosion Inhibiting Coatings—
H. F. Payne, University of Florida

10:30–12:00 Basic Lead Silico Chromate in Corrosion Inhibiting Paints–
Arnold Eickhoff National Lead Company

Lunch

1:00– 2:30 Microbiology of Paints Films, VII.–
R. T. Ross, Buckman Laboratories, Inc.

3:00– 4:30 Experience with House Paint-Coatings–
F. L. Browne, Forest Products Laboratory

Tuesday, February 3

8:30–10:00 Principles of Solvation–
H. F. Payne, University of Florida

10:30–12:00 Hydrocarbon Solvents–
T. Barker, American Mineral Spirits Co.

Lunch

1:00– 2:30 Hydrocarbon Solvents (continued)–
T. Barker, American Mineral Spirits Co.

3:00– 4:30 Oxygenated Solvents–
C. H. Thomas, Enjay Company, Inc.

Wednesday, February 4

8:30–10:00 P E Alkyds for Air-Dry Baking and Lacquer Coatings–
J. P. Landig and R. P. Silver, Hercules Powder Co.

10:30–12:00 Isophthalic Alkyds in Coatings–
N. E. Hathaway, Oronite Chemical Co.

Lunch

1:00– 2:30 Developments in Water-Thinned Vehicles–
R. Boller, Archer-Daniels-Midland Co.

3:00– 4:30 Polyamide Resins for Surface Coatings–
Don E. Floyd, General Mills, Inc.

6:00 Dinner Meeting–
Experiences in South America—Frank W. Putnam, University of Florida

Thursday, February 5

8:30–10:00 Titanium Pigments and Their Behavior with Extenders–
Fred Stieg, Titanium Pigment Corporation

10:30–12:00 Calcined Clays in Organic Coatings–
Harry B. Naylor, Southern Clays, Inc.

Lunch

1:00– 2:30 Developments in Polyvinylacetate Coatings–
N. G. Thompkins, Dewey and Almy Chemical Co.

3:00– 4:00 Lytron 680 in Exterior Paints–
C. H. Parker and J. A. Gordon, Jr.,
Monsanto Chemical Company

Friday, February 6

8:30–10:00 Developments in Acrylic Emulsion Architectural Finishes–
Gerould Allyn, Rohm & Haas Co.

10:30–12:00 Alkyd Emulsion for Architectural Finishes–
W. L. Hensley, American Cyanamid Co.

Lunch

1:00 Open Forum–General Discussion

•

Reichhold Plans Unit

Plans for a million dollar plant to be built in Houston, Texas for the production of synthetic resins have been announced by Reichhold Chemicals, Inc. The plant is scheduled for completion by mid-1959 and will be under the managership of Don Leever, currently the company's division director of technical service at Kansas City.

Location for the Reichhold plant is a 20 acre property on the Greens Bayou Waterway in the southeast suburban area of Houston. Construction for the project will start immediately.

•

Maass Consulting Service

Dr. Walter B. Maass announces the establishment of a consulting service for the paint and allied industry at 135 Front St., New York 5, N.Y.

W.B. Maass

During the last nine years Dr. Maass was technical director of the Adelphi Paint and Color Works and previously Chief Chemist with John L. Armitage & Co. He is also a partner in the Lack & Farbenwerke Vinzenz Wagner, Vienna, Austria.

Dr. Maass has recently returned from a four month trip to Europe, where he visited paint and raw material companies in Holland, Belgium, France, Switzerland and Austria.

PHOSPHATING PROCESS: Bennett steel drum entering first stage of six-stage cleaning and phosphating equipment where hundreds of high pressure nozzles spray the inside and outside of the drum in each stage. (Vapor almost obscures the rows and rows of nozzles in this action photograph.) The film of phosphate coating provides a continuous surface that inhibits both rust and corrosion and provides a base for better exterior paint and lining adhesion.

NEWS

Canco Forecasts Paint Increase

The nation's painters will use 335 million gallons of trade paint by 1961.

That's the forecast made in a study of the paint market just completed by American Can Company.

The company defined trade paint as paint, varnish and lacquer sold directly to consumers and jobbers through retail and wholesale outlets. Industrial paints are not included.

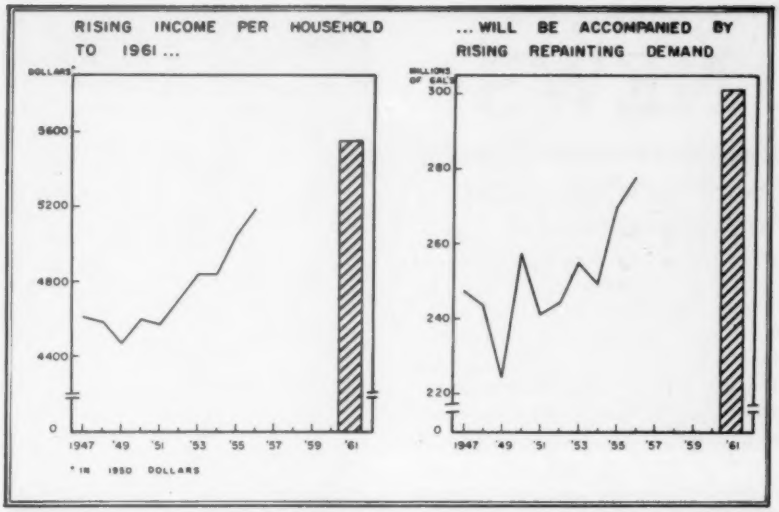
The consumption of 335 million gallons—301 for repainting purposes and 34 for new construction needs—represents a seven per cent increase over 1956 usage and is almost 26 per cent higher than the average used in 1947-1949.

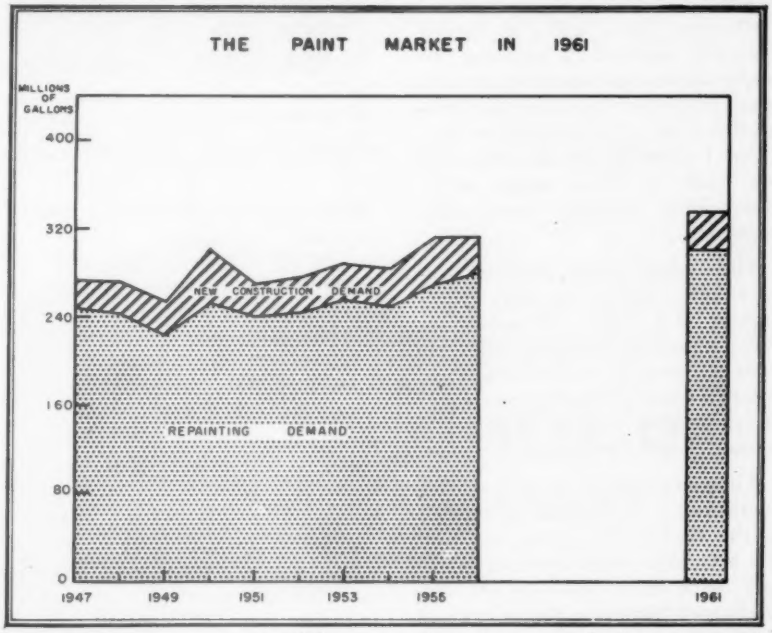
Main reason for the expected increase is shortening of the repainting cycle which in turn is caused by rising consumer income and the popularity of easy-to-use interior coatings, Canco said. An expected increase in new home construction also is expected to add to paint usage in that area.

Survey findings were: the greater a consumer's income, the more frequently he repaints his home; the popularity of latex emulsion water-thinned paints has spurred the "do-it-yourself" trend among homeowners; and that in 1961 a new wave of household formations (and thus home building) is expected to begin as the first of the heavy postwar baby crop mature and begin establishing families and homes of their own.

Income per household is expected to rise to $5,552 in 1961 as compared with $5,184 in 1956 (based on 1950 dollars) and approximately 1.1 million residential homes will be built, the most since the end of the building boom period in 1956.

This, Canco concludes, means that 1961 will be a good year for the paint industry. And, with new construction adding not only residential units but also non-residential buildings, in the form of schools, churches, stores and similar structures, many more buildings will need repainting in future years.





The company noted that an even greater increase could be expected if it were not for the decrease in usage of exterior paints. This is expected to trim about 19 million gallons from the potential use.

Responsible for the decreased usage are the greater use of non-paint surfaces in building construction and the development of a one-coat house paint, equal in performance to the old two-coat paint. The one-coat paint has made it possible to save time, money and energy in application but has, in effect, cut consumption approximately in half.

Canco said that its representatives in any of the company's more than 30 district sales offices throughout the United States will gladly furnish complete copies of the survey to those desiring more detailed information.

•

Esso Continues Supplies

Esso Standard Oil Company today reported it has been able—and will continue to be able—to supply the normal ethylene requirements of its Baton Rouge, La., customers from its own refinery there.

The compressor facilities of Esso's Baton Rouge ethylene plant were damaged by fire on Oct. 1. Two gas turbines, one steam turbine and seven compressors were damaged.

NEWS

Crown Cork Modernization Progressing Rapidly

Modernization and relocation of closure manufacturing facilities of Crown Cork and Seal Company's Baltimore plant is progressing ahead of schedule. The second phase of a three-year modernization program, which will cost more than $4 million when completed, will enable Crown to turn out in one square foot of operating space what formerly required three square feet. Production lines will be moved from old multi-story buildings to modernized single story structures, using improved tandem-type production lines. This transition, like Phase I of the program completed last Fall, is being made while maintaining normal production schedules.

The modernization program utilizes three existing one-story buildings as its nucleus. By enlarging, and connecting all three buildings with a common roof, Crown will create a total of 300,000 square feet of processing space which was formerly used for storage purposes.

The company's manufacturing operations in Baltimore are located in the Highlandtown section, and the area into which operations are now being centralized lies between O'Donnell Street on the north and Boston Street on the south. In addition to excellent public transportation connections, the modernized plant area will have an employee parking lot for 350 cars and has space for later expansion.

The first phase of the program, a million-dollar project of transferring crown production lines from older multi-story buildings to the new area, was begun early in 1957 and completed last Fall. This project established the most modern crown production methods in the industry. The decorated metal sheets are moved from the litho graphing operation directly to high speed stamping presses which are the beginning of a series of automatic processing operations that conclude with electronic counting and automatic packing of crowns into shipping cartons.

The second phase, which will cost $2.8 million, involves all operations concerned with screw cap and Dacro production.

Crown Cork & Seal Company, pushing forward with a Company-wide program initiated in 1957 to modernize and improve its operations, is currently making studies for the final phase of the rearrangement of the Baltimore plant. The third step, expected to be completed early in 1960, involves the relocation and relayout of its aluminum rolling and cork processing facilities. The expenditures required for the final step have not yet been determined.

N. Y. CLUB OFFICERS: Moe Bauman (extreme right) was installed as president of the New York Paint & Varnish Production Club at the annual meeting held on November 6. Other club officers (left to right) are John J. Oates, treasurer; Edward G. Fischer, secretary; and Benjamin Chatzinoff, vice president.

•

Increased Paint Sales Predicted by Battley

Great and profitable years loom directly ahead of the paint industry as paints and chemical coatings are improved and conceived, General Joseph F. Battley, president of the National Paint, Varnish and Lacquer Association, told the annual convention of the National Paint Salesmen's Association.

Declaring that the industry has good reason to be optimistic, General Battley said that there is every sound reason to believe that paints and chemical coatings are in "for a long run of ever increasing sales."

"Every increase in population increases our sales potential accordingly," he asserted. "As buying habits increase, as new homes are built. . . . .anywhere from a million and a quarter to three million new homes a year, according to which expert you read. . .as new uses for paint and chemical coatings are discovered and promoted, we can be emphatically optimistic."

Stating that the industry can justifiably pat itself on the back for its continuing scientific and technical progress, General Battley warned against "complacent optimism." He urged aggressive merchandising and aggressive optimism upon the part of the salesmen whom he described as having an abundance of ideas and imagination and ability to develop the merchandising and selling tools needed.

•

Continental Carbon Expands

Plans for the expansion of Continental Carbon Company's Carbon Black plant at Ponca City have been announced.

The project, which will raise the capacity of the Ponca City plant from 50,000,000 to 75,000,000 lbs. of oil furnace blacks annually, will start shortly and is expected to be completed by Fall 1959.

NEWS

Sidney Werthan Wins Paint Industry Award

Sidney Werthan, head of The New Jersey Zinc Company's Paint Research Laboratory since 1928, has just received one of the highest awards given to one associated with the paint industry, for outstanding achievement in the field of paint technology. At the recent Federation of Paint and Varnish Production Clubs Convention at Cleveland, Ohio, Mr. Werthan was presented with the 1958 George B. Heckel Paint Industry Award, in recognition of his work over many years in the development of technical information on the zinc pigments and their application in paint products.

S. Werthan

Mr. Werthan has long been known as one of the leading authorities on pigment and paint problems. He has written many articles for the industry's trade publications and has presented papers to virtually all clubs of the Federation in principal cities of the country. He is a member of the Philadelphia and New York clubs, American Chemical Society and American Society for Testing Materials.

•

N. Y. Club Talk

"Applied Radiation" was the subject of the talk presented by Bernard Manowitz to the New York Paint and Varnish Production Club. The occasion was the annual meeting and the regular monthly meeting of the Club on November 6th.

Mr. Manowitz, head of the radiochemical technology group of the Brookhaven National Laboratory of Upton, L. I. explained how radiation consists of streams of electrons or protons. Recently, much research has been made in applying intense radiation to initate chemical reactions.

TRIGG FELLOWSHIPS: Three engineering seniors were awarded Ernest T. Trigg Foundation fellowships at the University of Missouri, School of Mines and Metallurgy. Left to right: Thomas J. Meyer; Dr. Dudley Thompson, Chairman of the Department of Chemical Engineering; Hugh W. Haseltine; Melvin J. McCubbin; Dr. Wouter Bosch, Professor of Paint and Polymer Chemistry; and Dr. Curtis L. Wilson, Dean.

NEWS

Brantley Named Visiting Scientist at Lehigh U.

Dr. L. Reed Brantley, head of the department of chemistry at Occidental College, Los Angeles, Calif., has been named Visting Scientist at Lehigh University through a Petroleum Research Fund award of the American Chemical Society.

He will work with the chemistry staff at Lehigh during the coming year while he is on leave of absence from Occidental College.

Licensed as a chemical engineer in California, he has done research work in the fields of high temperature chemical equilibrium, x-ray analysis by powder photographs, chemistry of fluorine oxide, principles of adhesion, and environmental protective coatings.

Dr. Brantley, author of numerous articles published here and abroad, is president of Alpha Chi Sigma, honorary chemistry society, president-elect of the Division of Paint, Plastics, and Printing Ink Chemistry of the American Chemical Society, and chairman of the committee on chemical education of the American Chemical Society.

He is a graduate of the University of California, and received his master's and doctor of philosophy degree at the California Institute of Technology. He has been a member of the faculty at Occidental College since 1930.

•

Airco to Build

Air Reduction Sales Company, a division of Air Reduction Company, Inc., today announced that construction of a new oxygen and nitrogen plant at Denver, Colorado, is underway. Estimated cost of the new Airco facility, including related distribution equipment, will be in the neighborhood of $600,000. The general contractor is Stearns-Roger Manufacturing Co. of Denver, and it is anticipated that the plant will be completed and in operation by January 1, 1959.

Although for the past two years Air Reduction has maintained a supply store for welding and cutting equipment at Denver, from which both argon and helium gases have been made available, this will be the first time that the company has had a major gas-producing installation of its own in the general area. William O. Brown is in charge of all Airco operations at Denver.

•

Celanese to Expand

Celanese Corporation of America today announced plans to double the capacity of its acetic acid plant at Pampa, Tex. Work on the multi-million dollar expansion is scheduled to begin this year and to be completed by late 1959.

Richard W. KixMiller, Celanese vice president and general manager of the company's Chemical Division, said addition of the new facilities will enable the Pampa plant to produce 240 million pounds a year, or 15% of the nation's total requirements for acetic acid. Combined capacities of the Celanese plants at Pampa and Bishop, also in Texas, will give the company more than one-quarter of the nation's acetic acid capacity

The additional acetic acid also will be available for increasing output of two relatively new Celanese products—trimethylolpropane, used in the manufacture of polyurethane foamed plastics, coatings and synthetic lubricants, and acrylate esters, whose principal uses are in the manufacture of paints and coatings.

PERSONNEL CHANGES

NOPCO

Robert F. McClellan has been elected vice president and has also been appointed general sales manager of the industrial division it has been announced. In this position he will supervise the sales activities of the departments serving the tanning, paper, detergents, textiles, metal working, insecticides and protective coatings industries.

R.F. McClellan

Formerly vice president of Nopco Chemical Canada Ltd., Mr. McClellan has been associated with the firm for over 31 years. He began as a salesman for the agricultural division at Chicago, transferring to the industrial division in 1928. In 1944 he was appointed mid-west district manager and nine years later became head of the Canadian division, the former Yocum-Faust Chemical Co., at London, Ontario.

CELANESE

Edward W. Melvin has been appointed assistant director of sales, resin products department, it has been announced.

He will assist in all phases of sales activities related to polyester resins and polyvinyl acetate emulsions used in paints, adhesives, textile finishes and paper coatings.

Mr. Melvin joined the firm in 1956 as a paint specialist, and has worked out of the company's Newark, N. J., plastic division headquarters. He was in charge of industrial shellac sales for Haeuser Shellac Co. before joining the organization, and also worked in the lead pigments division of National Lead Co.

He is a 1943 graduate of Fordham University and has a B. S. degree in chemistry.

ECLIPSE AIR BRUSH

James L. Whalen has been promoted to vice president and sales manager, it has been announced.

Mr. Whalen has been associated with the firm for more than 11 years. He has been sales manager since 1954.

He attended the University of Virginia.

CROWN CORK & SEAL

George P. O'Brien has been appointed manager of can sales for the middle Atlantic region, it has been announced.

Operating from Philadelphia headquarters, Mr. O'Brien will work with district sales managers and sales representatives in the sales development of all company products.

A graduate of the University of Pennsylvania, Mr. O'Brien joined the firm as a sales representative in 1947. Since then he has served as assistant district sales manager, district sales manager, and consolidated district sales manager of the Philadelphia area.

Mark T. Concannon has been named manager of closure sales for the middle Atlantic region, it has also been announced.

Working with district sales managers and salesmen, he will assist in the sales development of all products of the closure division, basing his operations at the Philadelphia headquarters.

Mr. Concannon joined the firm in 1958. Prior to that, he was affiliated with Canada Dry.

SPENCER KELLOGG

Donald D. McCready has been appointed west coast technical service representative with headquarters in the Long Beach, Cal. office, it has been announced.

D.D. McCready

He succeeds **Earl B. Smith, Jr.,** who has assumed duties as manager of the special products department.

Mr. McCready joined the organization in 1947. Most recently, he was midwest technical service representative in Chicago.

He is a 1947 graduate of Virginia Polytechnic Institute and holds a B. S. degree in chemical engineering.

AMSCO

Robert L. Moore, Jr., has been appointed assistant manager of the New England sales division, it has been announced.

Mr. Moore has been with the company since 1948; first as a representative for the line of technical naphthas and chemicals in the Philadelphia area. For the past four years he has been in charge of the office in Memphis, Tenn.

John F. McMahon has been appointed a sales representative, it has also been announced. He will be marketing the firm's line of technical naphthas, industrial solvents and related chemicals in southern New England with headquarters at the company's Somerville, Massachusetts terminal.

Mr. McMahon joined the company in 1957 at the general eastern offices in Murray Hill, New Jersey where he served in the sales service department.

He attended Providence College and graduated with a Bachelor of Science degree in chemistry.

KENTUCKY COLOR

Larry Zehnder has been appointed to cover the southeastern, Indiana, and near midwestern areas, it has been announced.

L. Zehnder

Mr. Zehnder will call in conjunction with the R. T. Hopkins Co. and the Lastrapes Bros. in the south and as a direct representative in the other territories.

Mr. Zehnder has previously been with Jones-Dabney in Louisville, in their appliance finishes lab, and with Reynolds' aluminum pigments department as a co-op student while at the University of Louisville Speed School. He graduated in 1955.

RINSHED-MASON

Two appointments to the central litho coatings research and development laboratory in Detroit, Mich. have been announced.

M. Lowry

R. Johnson

Roscoe Johnson has been appointed manager of litho coatings and will direct the research and sales development efforts serving the national requirements of the metal decorating and food container industries. Mr. Johnson, who has served these industries for many years, was transferred from the west coast division.

McClellan Lowry, who recently joined the firm has many years of coatings experience, will work in cooperation with Mr. Johnson on litho coatings. He has been given charge of the technical service staff at the west coast plant in Anaheim, Cal.

DOW

Dr. William H. Schuette has been elected a company vice president, it has been announced. He will continue his duties as general manager of the Midland Division.

Dr. Schuette has been with the firm since 1941.

Dr. Schuette studied chemical engineering at Case Institute of Technology, receiving his B. S. degree in 1933, M.S. in 1939, and Ph.D. in that field in 1941.

G. J. Williams has been named to succeed **Donald L. Gibb** as sales manager of the plastics department, it has also been announced.

Mr. Gibb will continue his association with the company's sales department, assuming new duties as special consultant. He will be concerned especially with activities in the plastics field.

Mr. Williams joined the organization in 1948 and has been assistant to Mr. Gibb since 1956.

DU PONT

Harold A. Medeiros has been appointed export sales manager of the fabrics and finishes department, it has been announced. He will succeed **Ralph Plowman,** who has retired.

Mr. Medeiros, who has been assistant export sales manager since 1953, joined the firm in 1929 as an export sales correspondent in the fabrics division at Newburgh, N. Y.

Mr. Medeiros was graduated from the University of Maine in 1929 with the degree of bachelor of arts.

EMERY INDUSTRIES

Four additions to the organic chemical sales department staff of Emery Industries have been announced. **Robert S. Haley** has been appointed to the New York office; **J. Warren Sackett,** the Cleveland office; **Walter R. Paris,** the Lowell, Mass., office; and **Robert H. Endres** has been assigned to a newly-created territory with headquarters in Pittsburgh.

Mr. Haley transfers to the organic chemical sales department from the Vopcolene Division, for which he served as eastern sales representative prior to its acquisition by the firm earlier this year. In his new position he will handle all non-textile chemicals in the Organic Chemical line.

Mr. Sackett was general manager of Bay Rubber & Plastics, Inc., before joining the firm. He will handle the entire organic chemical line in eastern Michigan and the state of Ohio except the southeastern portion. A graduate of Ohio State University, Mr. Sackett has also taken graduate work at Case Institute of Technology.

Mr. Paris was formerly with Godfrey L. Cabot, Inc., where he was New England sales representative. He will sell non-textile chemicals in all of New England and upper New York State. He is a graduate of Harvard University.

Mr. Endres formerly was associated with Standard Oil Co. (Indiana). He is chemical engineering graduate of the University of Colorado.

C. M. AMBROSE

A. J. Passonno has joined the firm, it has been announced.

His territory comprises the five states of Alabama, Mississippi, Louisiana, Georgia, and Florida.

AIR REDUCTION CHEMICAL

The following executive appointments have also been announced:

J.M. Tinnon, sales manager, was named vice president in charge of sales and new product development activities. He will also coordinate new product work of the division with the central research laboratory at Murray Hill, N.J.

R.A. Wilson, manager of operations, has been appointed vice president of production and engineering. Coordination of process development work with the research and engineering departments will also be his responsibility.

Dr. G.B. Carpenter, manager-development staff, has been named director of development for the chemical division, responsible for technical-commercial intelligence, both in this country and abroad. He will also assist in the development and definition of new projects in the chemical field.

Fred T. Wilson, Jr., assistant manager-sales of Air Reduction's sales office at New Orleans, has been appointed manager at that location, it has also been announced.

E. C. Kennedy, salesman, New Orleans, succeeds Mr. Wilson as assistant manager-sales.

With the company since 1947, Mr. Wilson served in various sales capacities for Airco at Louisville, Ky., and Nashville, Tenn.

Mr. Kennedy has been with the firm for six years and previously was a salesman at Shreveport, La. and Mobile, Ala.

REICHHOLD CHEMICALS

Ralph T. Urich, vice president-general sales manager, has been named to the board of directors for the company, it has been announced.


R.T. Urich

The announce- came less than six months after Mr. Urich's appointment to the vice presidency and climaxed a 19 year association with the company.

He joined the firm in 1939 to engage in sales and research work on inorganic color pigments and has since been closely indentified with similar work on all of the basic chemicals and resins produced for industry by the company.

Martin P. Kerins and **Jack Siegelbaum** have been appointed product managers for the chemicals division, it has also been announced.

Mr. Kerins joins the company after an association with Stauffer Chemical Company of New York, where he last served as national accounts sales manager. Mr. Siegelbaum comes to the White Plains headquarters through a promotion from the company's eastern sales division, whose offices are in Elizabeth, N. J.

Between them, these men will have the responsibility for the sales of the basic chemicals currently manufactured by the company.

CIBA

Frank E. Pschorr has become manager of structural technical service and development laboratories, and **O. L. Nikles** has been appointed manager of coatings technical service and development laboratories, it has been announced.

SYNKOLOID

Sidney J. Burgeson has been named vice president in charge of production, it has been announced.

Prior to joining the firm four years ago, Mr. Burgeson spent 27 years with The Reardon Company, the last several years as general production manager.

CALIFORNIA INK

Jack Barry has been promoted to manufacturing director, it has been announced.

J. Barry

His major responsibility will be the direction of manufacturing operations in the Berkeley, Cal. plant.

Mr. Barry majored in chemistry at St. Francis College in New York City. In 1946, he joined the staff of chemists in Berkeley. In the ensuing twelve years he gained broad experience in vehicle and color dispersions for both the ink and paint industries.

UNION CARBIDE CHEMICALS

Four technical representatives have been transferred, it has been announced.

The transfers are: **D. Wallace Enright** from the Charlotte district to the Chicago district; **Alan J. Lyon** from the general sales office to the Charlotte district; **Alan R. Mitchell** from the New York district to the Philadelphia district, and **Joseph L. Suhadolnik** from the general sales office to the Newark district.

Dr. Malcolm B. VerNooy has been promoted to product manager in the new chemicals group, it has also been announced.

In his new position, Dr. VerNooy will direct the market development chemicals that are used in resin applicatiosn, and will be responsible for the marketing of acrylates.

Dr. VerNooy received his Ph.D. from Yale University in 1948. He joined the firm in 1953.

SHAWINIGAN RESINS

Raymond C. Schuler has joined the Chicago district sales office, it has been announced.

Mr. Schuler, who formerly was with the research development department of Swift and Company, received a B. S. degree in chemical engineering from the University of Detroit in 1954.

CALIFORNIA CHEMICAL

E. R. Camarena has been named technical consultant in South America, it has been announced.

Mr. Camarena was formerly with the sales staff in San Francisco. In his newly-created position, he will be headquartered in Sao Paulo, Brazil, and will be the company's first full-time representative in South America.

Also announced was the appointment of **Ivan Breval** to replace Mr. Camarena on its San Francisco staff. Mr. Breval was formerly with Standard of California, which he joined in 1954.

NATIONAL STARCH PRODUCTS

Marc Archambault has been appointed supervisor—technical service, for the Montreal Division of National Adhesives (Canada) Ltd., a subsidiary of the firm, it has been announced.

In his new position, Mr. Archambault will direct technical service on all products, including base resins, packaging and structural adhesives and starches.

Mr. Archambault has been with the company since 1948 and has supervised technical service in the Toronto division since 1955. He is a Bachelor of Science graduate of the University of Montreal.

Al Tate has been appointed supervisor—technical market development for the Toronto Division of National adhesives (Canada) Ltd., a subsidiary of the firm, it has also been announced.

He will be responsible for both sales and technical development on base resins and specialty starches.

Mr. Tate joined the company in 1955 with extensive prior technical experience in paints. He has been active in development work on structural adhesives and base resins.

Mr. Tate holds a B. A. in Chemistry and an M. A. in Physical Chemistry from Queens University, Kingston.

ENTERPRISE PAINT

Robert Miesen has been appointed a factory representative, it has been announced. He will cover Minnesota, eastern and northern South Dakota and northern Wisconsin.

Educated at the University of Minnesota, he has had eleven years of experience in the paint business at both the retail and wholesale levels. As factory representative, Mr. Miesen will work with dealers on advertising and merchandising program that will help to increase store traffic and sales.

CLASSIFIED ADVERTISEMENTS

Rates: $.20 per word, except those seeking employment, for which rate is $.10 per word. Minimum: ten words. Address all replies to Box Number, c/o Modern Sanitation, 855 Avenue of the Americas, New York 1, New York.

GENERAL MILLS

The following changes have been nounced:

Robert W. H. Chang has been promoted to the position of group leader in the central research laboratory, Minneapolis, Minn.

Mr. Chang joined the firm in 1951, after having received a Master's degree from the University of Minnesota. His under-graduate degree was obtained at National S. W. Association University in China in 1946.

Dr. Simpey Kuramoto has joined the central research laboratories as a project leader, primarily to carry out research in the field of proteins.

Dr. Kuramoto received his Ph.D. from the University of Minnesota in 1955.

Donald L. Andersen has been promoted to the position of group leader in the central research laboratories.

Mr. Andersen came to the firm in 1950, after having received a Bachelor's degree in chemistry from Northwestern University. He has also done graduate work at the University of Minnesota.

Fred Buchanan has joined the special commodities division and **Cy Ducharme,** representing the special commodities division in the sale of guar products, has been transferred from Minneapolis to Jacksonville, Fla., it has also been announced.

Mr. Buchanan will represent the division in the sale of guar products, headquartering in the Minneapolis office.

His previous positions of responsibility include associations with Crystal Tissue Co., Waldorf Paper Products, and National Gypsum.

Mr. Buchanan attended Tri-State College where he majored in chemical engineering.

Mr. Ducharme's new territory includes the Atlantic southeast and south central United States.

He previously was the firm's midwest representative to the paper industry.

Mr. Ducharme is a graduate of the University of Minnesota.

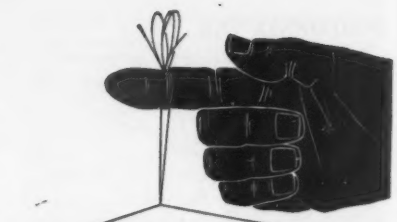
G. S. Kennedy, a veteran of 44 years with the firm, has been elected to the newly created position of executive vice president, it has also been announced.

Mr. Kennedy began his career with the company in 1914. He was elected a vice president in 1943 and a director in 1948.

ORONITE

C. J. Oldenburg has been appointed manager of the Chicago sales district, it has been announced.

Mr. Oldenburg was formerly a sales representative in the Chicago district, which includes nine midwestern states. He joined the firm in 1944.



CALENDAR

Jan. 19-21. Committee D-1 on Paint, Varnish, Lacquer and Related Products, Deshler-Wallick Hotel, Columbus, Ohio.

Feb. 19-20. Annual Divisional Conference of the Protective Coatings Subject Division, Chemical Institute of Canada, Toronto and Montreal, on Respective Dates.

Dec. 9-11. Annual Meeting of the Chemical Specialties Manufacturers Assn., Commodore Hotel, New York, N. Y.

PRODUCTION CLUB MEETINGS

Baltimore, 2nd Friday, Park Plaza Hotel.

Chicago, 1st Monday, Furniture Mart.

C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar.,
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April, Suttmilers.
Columbus — Jan., June, Sept., Fort Hayes Hotel.

Cleveland, 3rd Friday, Harvey Restaurant.

Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.

Detroit, 4th Tuesday, Rackham Building.

Golden Gate, 3rd Monday, Sabella's Restaurant, San Francisco.

Houston, Monday prior 2nd Tuesday, Rams Club.

Kansas City, 2nd Thursday, Pickwick Hotel.

Los Angeles, 2nd Wednesday, Scully's Cafe.

Louisville, 3rd Wednesday, Seelbach Hotel.

Montreal, 1st Wednesday, Queen's Hotel.

New England, 3rd Thursday, University Club, Boston.

New York, 1st Thursday, Brass Rail, 100 Park Ave.

Northwestern, 1st Friday, St. Paul Town and Country Club.

Pacific Northwest, 3rd Thursday, Wahington Athletic Club, Seattle, Wash.

Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.

Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.

Rocky Mountain, 2nd Monday, Republican Club, Denver, Colo.

St. Louis, 3rd Tuesday, Kings-Way Hotel.

Southern, Annual Meetings Only.

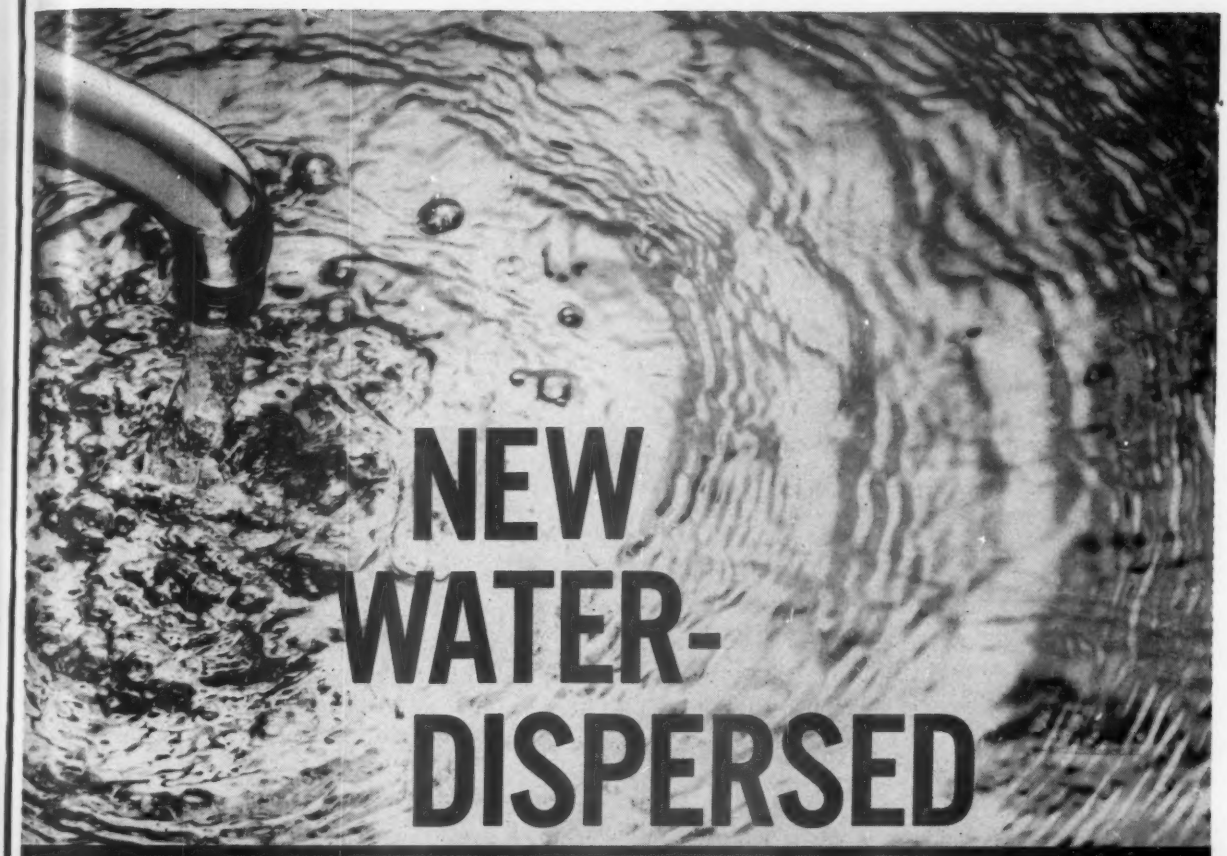
Toronto, 3rd Monday, Oak Room, Union Station.

Western New York, 1st Monday, 40-8 Club Buffalo.

SUBJECT INDEX for VOLUME 48
January-December, 1958

AUTHORS' INDEX for VOLUME 48
January-December, 1958

ADVERTISERS' INDEX



NEW WATER-DISPERSED

CYAQUA* 405-20

THE STABLE ALKYD EMULSION

amazing flat paint vehicle combines best features of latices and alkyds

CYAQUA emulsion paints

- contain no organic solvents, casein or protein
- brush out evenly and easily
- clean up readily with water
- have no "stage" in the dry
- produce dead flat sheen
- have excellent adhesion
- hide well in one coat
- resist scrubbing

CYAQUA emulsion

- has unusual stability
- good freeze—thaw resistance
- has excellent emulsifying and dispersing characteristics
- disperses pigment readily, tolerates high pigment loading
- does not form irreversible solid at any drying stage
- does not clog equipment
- contains no external plasticizer, thickener, antioxidant or protein
- non-foaming
- excellent compatibility with latices

*Trademark

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Est. 1870

DUPLEX DISPERSER*

Produces Finished Product in One Operation

Compact unit combines powerful disperser head with rugged diamond-shaped agitator to produce finished batches *without further milling* for the majority of inks and paints. Modern design gives proportional hydraulic shear, kinetic impingement and mulling action for better wetting, improved color dispersion, and uniform blending.
Send samples for trial processing.

*Trademark—Patent Pending

COLLOID MILL

With Triple Action Design

Utilizes three zones of action — at upper face of rotor, between peripheral surface of rotor and housing, and between under face of rotor and housing — for better emulsions and finer dispersions. Unit design prevents aeration of materials. Clearances adjustable while unit is in operation by calibrated adjusting ring.

ROLLER MILL

With *One Point* Adjustment "Floating Roll" Principle

For high speed precision-controlled dispersion and grinding of ink, paint, coatings, and similar products. Floating Roll principle minimizes roll distortion gives maximum grinding surface. Exclusive one-point adjustment speeds clean-up time and provides quick, accurate resetting of rolls.

Write TODAY for new 1958 TROY Processing Equipment Catalog and name of your nearest dealer.

TROY Engine & Machine Co.

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Send Sample of Your Material for Trial Processing. No Obligation.